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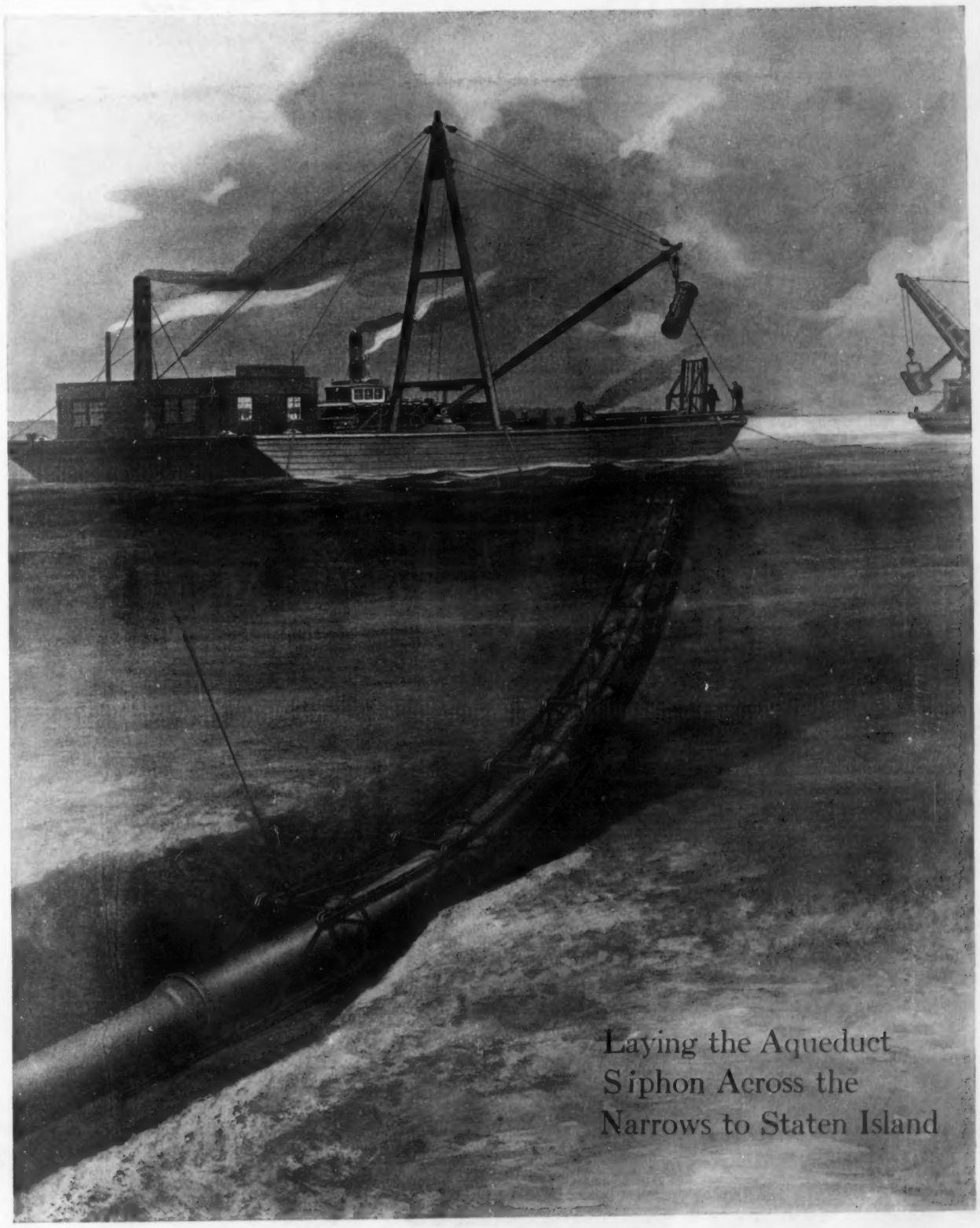


Laying the Aqueduct Siphon Across the Narrows to Staten Island

Vol. CXI. No. 15
October 10, 1914

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents
$3.00 A Year

HUDSON Six-40-$1550

$3,875,000 Last Month Paid for Hudson Sixes

$930,000 Weekly

These figures tell better than words can how men are flocking to this new-day car. In September, buyers of new cars paid $3,875,000 for this HUDSON Six-40 alone.

This averages $930,000 weekly. That is they are buying as fast as we build—100 cars daily.

No Other Class Car So Appealing

This is the largest sale of the season of a class car. Or by any car priced above $1200.

And it comes at a time when men are buying more carefully—comparing more closely—demanding more refinements than ever before. It comes at the climax of men's rebellion against over-tax and excess.

At this time—with all the new-year models out—men are buying five times as many HUDSONS as they bought one year ago.

Hudsons Now at Top

HUDSON models—designed by Howard E. Coffin—have been climbing up fast in late years. The HUDSON Six of two years ago was the largest-selling Six in the world.

But this new Six-40 has developed an avalanche of favor. In a single year it has quintupled HUDSON popularity. It has made the HUDSON—all things considered—the top-place car of today.

Note this one-year record. The first-model Six-40 came out a year ago. It outsold our output by 3000 cars. This 1915 model came out in July. We trebled our output to meet the demand for it. But on August 1 it was 4000 cars oversold. Now—with an output five times last year's—we are barely filling orders.

This is the Car Men Wanted

Four years ago, Howard E. Coffin—the great HUDSON designer—conceived this new-type car. He saw the trend of motorists' wants, and he started then to meet them. Since then—for four years—he has worked on this car. And the whole HUDSON corps of 47 engineers has worked with him.

He saw the end of awkward over-size. Here is a modest-size car with seats for seven and ample room for seven.

He saw the end of excess weight, due to wrong materials and crude designing. He has saved you here about 1000 pounds—the weight of a car-full of people.

He saw the demand for economy. With a new-type motor he has reduced operative cost about 30 per cent in this car.

He saw how beauty, comfort and convenience appealed to motor buyers. He has given you here—in all these ways—many unique attractions. Every detail—every part—has been refined in four years to the limit.

And he saw the demand for lower-priced quality cars. And here he gives you—through HUDSON efficiency—the lowest-priced class car built.

The Finished Ideal—Go See It Now

Today—at every HUDSON showroom—is the finished model of this new-day car. You will see every perfection—every refinement—which 48 men in four years have worked out.

And now all 1915 rivals are out to compare with it. This is the time to select your new car.

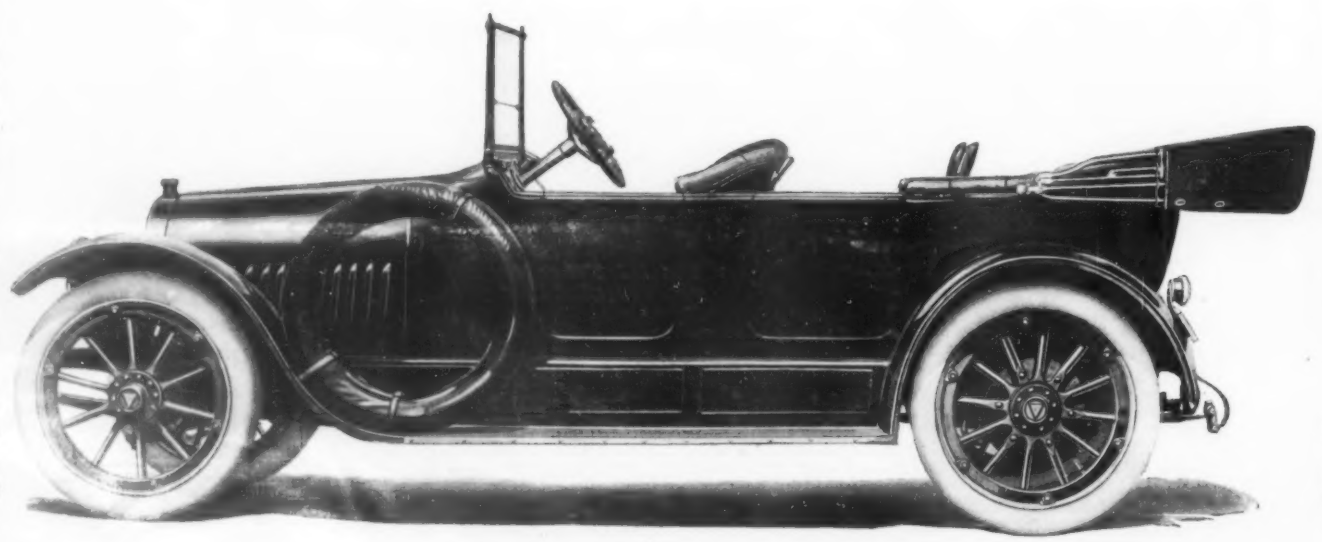
If you want an open body, there are months of fine driving ahead of you—the finest of the year. If you want a closed body, promptness will insure that you get it.

Go this week and see this HUDSON Six-40. If you prefer one at once, and your dealer can't deliver, we will ship one by express. Hudson dealers are everywhere.

Five New-Style Bodies

Seven-passenger Phaeton, $1,550; 3-passenger Roadster, $1,550; 3-passenger Cabriolet, $1,750; 4-Passenger Coupe, $2,150; new Town Car, $2,550. All f. o. b. Detroit. Canadian Price: Phaeton or Roadster, $2,100 f. o. b. Detroit, Duty Paid.

HUDSON MOTOR CAR COMPANY, 8338 Jefferson Ave., DETROIT, MICH.



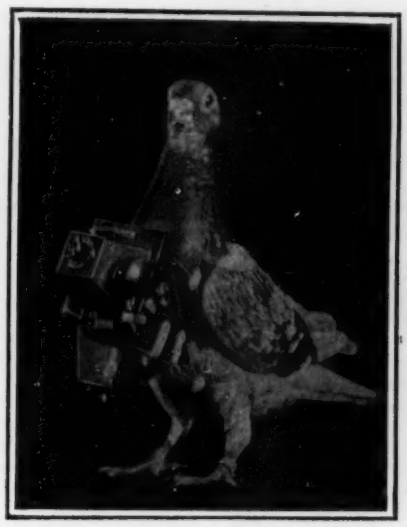
SEVENTIETH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXI. NUMBER 15.] NEW YORK, OCTOBER 10, 1914 [10 CENTS A COPY $3.00 A YEAR

Portable, collapsible cote for military use.



Carrier pigeon equipped with a two-lens camera.

Magnified picture taken by a carrier pigeon.

The Military Carrier Pigeon Photographer

The Homing Pigeon in the Army

MILITARY photographic "bird's eye views" have hitherto been obtained by means of balloons, kites, or rockets. Dr. Neubronner has discovered that they may be taken also with the aid of carrier pigeons.

It is not easy to construct an automatic camera with a maximum focal length of 2 inches and a maximum weight of 2½ ounces, including all appurtenances, but the problem was finally solved by a Frankfort firm. One form of the apparatus comprises two complete cameras, with their lenses directed forward and backward, so that at least one land view is obtained when both plates are exposed simultaneously in any position of the bird. The cameras are mounted on a thin aluminium cuirass which is attached to the bird by straps and rubber bands.

The shutter is released by a spoon-shaped lever. The bowl of the spoon is pressed outward by a hollow rubber ball filled with compressed air and perforated by a very small orifice. As the air slowly escapes, the ball collapses and the lever moves until it releases the shutter and makes the exposures at a moment that can be pretty accurately determined in advance. The pictures are 1½ inches square. Another form of the apparatus contains a single lens and a strip of film on which eight pictures are taken at definite intervals with the aid of the air ball and clockwork. The number of pictures may probably be increased to twenty-four or thirty.

The carrier-pigeon photographer can render valuable service in many fields, and especially in the field of war, for obtaining information of the country and the position and strength of the enemy. The Prussian Minister of War has shown interest in the project and has put at Dr. Neubronner's disposal birds from the military pigeon station at Spandau, with which successful experiments have been made. The carrier pigeon flies at a height of between 150 and 300 feet, safe from small shot and very difficult to hit with bullets. Pigeons can be released from airships at any height within the enemy's lines, and they would carry home with them pictures of great value. The carrier pigeon is peculiarly well suited to service of this character because, when set free in a strange place, it commences its flight by describing a spiral curve, in the course of which several pictures could be taken from various points of view. Then, when the pigeon has determined the position of its goal, it flies thither in a straight line at a uniform speed of about 40 miles per hour. As the moment of exposure can be regulated with a fair degree of precision, the object which it is desired to photograph can generally be caught. In besieged fortresses information concerning the besiegers can be obtained by tumbler pigeons which, when released at their homes, fly in circles for a time and then return to their cotes.

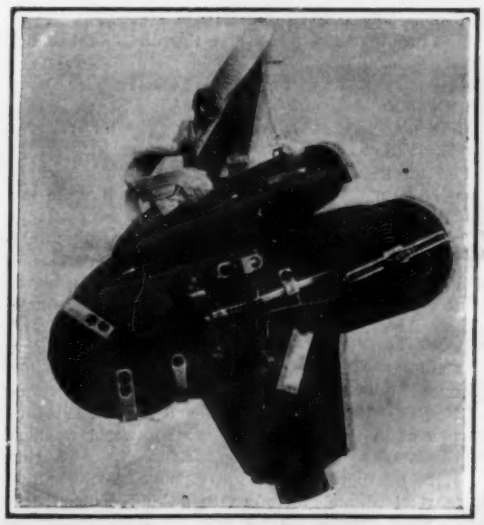
In field service it will be necessary to provide portable cotes for the carrier pigeons. A pigeon can see and recognize its cote at a distance of more than twenty miles. Dr. Neubronner has devised a wagon carrying a developing room and a cote which can be raised on "lazy tongs" in order to release the pigeons at a good height.

War Will Not Halt the Panama-Pacific International Exposition

EARLY in August, in response to numerous inquiries, the management of the Panama-Pacific International Exposition announced that the exposition would not be postponed, but at that time no word had been received from any European nation as to what effect the European war would have upon its plans. In the last six weeks, however, it has become evident that many European nations will be represented at San Francisco.

Of the forty foreign governments which have committed themselves to participate, not one has withdrawn. Holland has increased its appropriation from $100,000 to $400,000 and ordered that construction be rushed upon the great Netherlands pavilion, and Spain, which had not decided to participate officially before the war, has since voted an initial fund, $100,000, for participation.

England, Germany, and Austria will be represented by individual exhibitors or by associations of exhibitors, and France has cabled that her plans are unchanged. Norway is proceeding actively with her plans, and Denmark broke ground for her pavilion the first week in September. The Argentine Republic, in view of the new trade alignments between the American continents, has increased its appropriation from $1,250,000 to $1,750,000; Italy has ordered construction rushed upon her great pavilion.



A 2½-ounce apparatus for taking eight pictures.

The Grand Duchy of Luxemburg, despite the war, has prepared and shipped a marvelous exhibit of unnamed roses to compete for the $1,000 prize for the Panama-Pacific International Exposition Rose.

Since the war broke out there has been a very sharp increase in the demand for exhibit space from the manufacturers of the United States, South America and the European nations not at war; and while there is now no doubt that many European nations will be represented at the exposition, it is apparent that in addition, there will be an unprecedented representation from South America and the Orient, as well as from Central America.

Color-Blindness

DURING recent years the subject of color-blindness has received much attention, especially in relation to men working on railways and on ships. Engine-drivers and ships' officers are now subject to examinations as regards their sight, both in respect to its strength and also to the power of discriminating between different colored lights. Many tests have been devised by means of wools and colored counters by which the sight of such people can be tested. It has now been found that color-blindness is always inherited, and that a man whose ancestry is free from it never exhibits it. Curiously, as was explained by Prof. William Bateson, in his presidential address, delivered before the British Association at Sydney on August 21st, color-blindness is always inherited through the mother, and never through the father. There appears to be no instance in which a color-blind father has transmitted his defect to his children except in connection with a mother who was a transmitter. It does not follow, however, that the mother herself need be color-blind, but she must have inherited the power of transmitting this defect from the ancestor. Some, probably all, the daughters of a color-blind father inherit the power of transmitting the defect, although they themselves may not be color-blind, and, as a rule, they transmit it to about one half of their offspring of both sexes. The sons who inherit color-blindness are, of course, color-blind, but they do not themselves transmit it; it is the inheriting daughters who become the transmitters to the next generation. These facts ought to be of considerable assistance in the future to those who are responsible for investigating the eyesight of engine-drivers and officers of ships, provided that they are able to carry their investigations back through at least a couple of generations in the family. If it can be shown that two generations are free from color-blindness there is at least very good reason for supposing that the third generation will also be free.—*Engineering.*

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, OCTOBER 10, 1914

Published by Munn & Co., Incorporated. Charles Allen Munn, President; Frederick Converse Beach, Secretary
Orson D. Munn, Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

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Subscription Rates

Subscription one year $3.00
Postage prepaid in United States and possessions. Mexico, Cuba, and Panama
Subscriptions for Foreign Countries, one year, postage prepaid, 4.50
Subscriptions for Canada, one year, postage prepaid 5.75

The Scientific American Publications

Scientific American (established 1845) ..... per year, $3.00
Scientific American Supplement established 1876. " " 5.00
American Homes and Gardens ..... " " 5.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application
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Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

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The Battleship Versus the Submarine

NOT many months before the start of the present war, Admiral Sir Percy Scott stated his conviction that the submarine was already so far the master of the battleship, that it was unlikely that many more of the latter would be built.

A month before the breaking out of the present conflict, one of the most capable and farsighted of the officers of our navy, in discussing Sir Percy's statement with the writer, said that in the event of a naval war between two great powers, such, for instance, as Great Britain and Germany, it was quite possible that the battleship fleets of both navies would not dare to cruise on the high seas, in the proximity of the enemy's bases, until the submarine fleets of one or other of the contestants had been practically destroyed.

To many students of the war, it will appear that the sinking by a single submarine (if the German statement is correct) of three large armored British cruisers in less than one hour, is strong confirmation of the views of these two officers of the British and United States navies.

Already, as the result of this brilliant exploit, it is being freely stated that at any time we may learn that several of the British battleships have met a similar fate. This view is based upon the belief that the battleship fleet of Great Britain is engaged in a close blockade of the German coast, and is cruising to and fro a few miles off Wilhelmshaven, Helgoland, and the entrance to the Baltic. If this were the case, the peril of the submarine would be great indeed.

As a matter of fact, the battleship fleet, it may be safely said, is not within a hundred miles of the German coast. We hazard the statement that it is gathered at some mine-protected base, a roadstead or harbor on the English or Scottish coast, and the blockade of the German coast is being maintained by a fleet of cruisers, scouts, and destroyers, each squadron of which is patrolling its own assigned stretch of water and keeping in touch by wireless with the distant battleship fleet.

It is the principal duty of these ships of lesser value to keep close watch and detect the first signs of the German battleships passing out into the North Sea. In that case, Admiral Jellicoe would maneuver to gain contact with the enemy and bring on a general engagement. In fact, the only motive of Admiral Tirpitz himself in venturing into the North Sea would be to fight a line-of-battle engagement.

The absence of any coaling base would render it impossible for the German fleet to make any extended raid upon the English and French coasts, and a general engagement against such overwhelming odds as sixteen battleships against thirty or more would spell disaster.

It will be remembered that Admiral Togo waited for the Russian fleet behind one of the islands of the sea of Japan, and threw forward a screen of scouts, to get in early touch with the Russians. It is practically certain that the British battleships are far removed from the field of probable submarine attack, and that, like the German battleships, they are so located that they can be protected by a complete cordon of mine fields, torpedo booms, nets, and heavy interlaced cables.

The blockading fleets of lighter and less valuable vessels must necessarily cruise within observing distance of the coast, and these vessels are, and throughout the whole war will be, exposed to submarine attack. There is no doubt that the submarine flotillas of the Germans have been actively engaged in hunting for these ships ever since they appeared in the offing. The best protection for the cruisers and destroyers is to steam at not less than fifteen knots, and to make constant changes of course and cruising ground. Such a submarine as the "U-9," which sank the armored cruisers, can make only eight knots, when submerged; and at that low speed it is difficult to close in on a ship moving at fifteen knots or more. The ships that were sunk were making only seven knots, a fatally low speed, as the event proved, in waters infested by submarines.

The Germans will be greatly emboldened and the British rendered more cautious by the recent disaster; but in spite of all watchfulness, it is certain that now and then we shall hear of other blockade and patrol ships being intercepted and sunk by this comparatively new and justly dreaded form of attack.

The Seven Wonders of the Modern World

THE contest which the SCIENTIFIC AMERICAN conducted about a year ago with the object of ascertaining what are the ten greatest inventions of our time—inventions, in other words, which have been commercially introduced within the last twenty-five years, seems to have inspired the European press with the idea of conducting similar inquiries. The *Berliner Lokalanzeiger* recently asked its readers "What are the seven wonders of the modern world?" thereby bringing down upon itself a veritable avalanche of replies. No less than 151,764 readers of the paper were heard from, each having promptly reacted with seven answers.

The result of the contest is illuminating, not because it definitely establishes what are the seven wonders of the modern world, but how great is the power of publicity, how responsive is the general public to the influence of the press. For example, 17,148 votes were cast for wireless telegraphy; 16,259 for the Panama Canal; 12,828 for the flying machine; 11,428 for applications of radium; 11,296 for the moving picture machine; and 6,276 for the steamship "Imperator." All of these have received much publicity. Wireless telegraphy is placed in the first rank by less than one eighth of all the votes. Apparently 134,616 contestants either never heard of Marconi and his achievements, or did not consider wireless of much importance.

In commenting upon the psychological aspects of this contest, a writer in *Prometheus*, the well-known German scientific periodical, points out that the voters were not able to bring forward the necessary proof that a single one of their selections is a world wonder in the accepted sense. It would not have been too much to ask that all the 151,764 voters should have agreed upon at least one modern wonder. If there is one supreme modern achievement, surely all would have noted it.

Even assuming that seven modern wonders were to be enumerated, and that accordingly there is more than one really great wonder, it may be further assumed that 151,764 votes would be cast for at least two or three achievements. But even wireless telegraphy, which received the most votes, was not elected to its position with the usual majority of votes; only one eighth of all the votes were cast for wireless.

The writer in *Prometheus* examined the psychological side of this contest by classifying the wonders according to their nature. He finds that they fall into three classes:

a. Scientific discoveries, such as wireless telegraphy and the application of radium.

b. Pure inventions such as the dirigible balloon, the flying machine, and the moving picture machine.

c. Remarkable structures, such as the Panama Canal and the steamship "Imperator."

How do the 151,764 voters estimate the relative merits of these wonders in their particular classes?

The selection of wireless telegraphy by 17,148 people must be at once commended on this basis, despite the paucity of votes. On the other hand, the Panama Canal has received almost as many votes. Conceding that the Panama Canal is really a noteworthy achievement, still it must be admitted that the success of the achievement depended in large measure upon unlimited financial resources. The same applies to the "Imperator." Moreover, the "Imperator" has been exceeded in size by the "Vaterland," and the "Vaterland" will probably be exceeded in the future by still other vessels. Admitting that the Panama Canal and a giant ship are wonderful in their way, they are not world wonders in the true sense of the term. Hence their selection must be attributed to the great publicity which they have received and therefore to a kind of mob suggestion.

What remains? Radio-active investigations in the field of pure science; the airship, the flying machine and the moving picture machine in the field of technology. This would seem to indicate that technology is able to offer more world wonders than any other form of human activity. This again, in view of the publicity given to great inventions and the part they play in daily life, is to be expected. After all, but very few people in the world have anything like a profound knowledge of scientific problems. How little does the average person know of the wonders of the microscope, astronomy, spectroscopic analysis, chemistry, or physics, or for that matter, even of surgery? Surely the work of an investigator like Sir J. J. Thomson, the investigations of a Wasserman or an Ehrlich, deserve to be mentioned with the great work of great inventors. If we are to regard the Panama Canal as a world wonder, simply because it is big, we might also speak with the same fervor of the Key West Railroad, the great suspension bridges that hang over the East River, the Woolworth Building, and similar engineering work.

The contest did not reveal what are the seven wonders of the modern world, but it did reveal that 151,764 persons could not agree upon a single human achievement which deserved to outrank all others.

Scientific Men and Conscription

AT the conclusion of the war now raging in Europe the world at large will undoubtedly adopt one of two alternates. Either there will be a great general movement in the direction of disarmament and permanent peace, or there will grow up among all nations an increased preparedness for war. Of these two alternatives the first is the more probable. The stupid and avoidable waste of life and treasure, the disorganization of the world's commerce, and the set-back given to civilization will awaken a shuddering disgust throughout the world. Efforts will be made to secure a world-peace.

But supposing that through lack of intelligence or collective will these efforts prove abortive, we are faced with the other alternative. One consequence of this will be that England and America, in common with other countries, will sooner or later be led to adopt conscription, and it is one aspect of this that we propose to discuss. We wish to point out that certain small sections of the community should be exempt from conscription, and that for several reasons scientific men and artists of proved ability should not be required to fight. They could, of course, volunteer, but they should not be compelled.

Scientific men and artists are essentially cosmopolitan creatures. Their work is in no sense local: they do not benefit any one nation in particular, but the world at large; and so far as the ultimate good of the human race is concerned they are undoubtedly the most valuable class in the community. They are of incalculable value to the world in all that pertains to the advancement of mankind. They are the trustees of the future. Regarded in this way they count enormously, but there is no reason to suppose that as warriors they would be more efficient than any other class. The probability is that with their generally rather poor physique and lack of practical intelligence, they would be less efficient as fighters than the average man. Their numbers are small and their fighting abilities slight.

Surely one of the most appalling things about the present war is the fact that some of the most brilliant young men in Europe, men who cannot be replaced, have been ruthlessly butchered. These men belong to the wider issues. Science is more important than the preservation of any one country's independence. An effective remedy for cancer is worth a colony. It is merely a question of economics. As a matter of probability, the loss of these lives entails an inconceivably greater loss than any gain their presence in the fighting line is likely to bestow.

The "California" Class of Battleships

ALTHOUGH the three battleships of the "California" class, an illustration of which was given in our issue of September 26th, are practically identical with the "Pennsylvania" and "Arizonia," it has been decided to give them a separate class name. The "Pennsylvania" and "Arizona" will have the usual ram bow, which they were designed to carry. The "California" class, which will be known as the "California," the "Idaho," and the "Mississippi," will be distinguished from them by carrying the clipper bow shown in our illustration of the new ship.

It has been the broad policy of our navy to build our battleships in classes of five each, so that the active fleet in commission will consist of divisions of four ships in active service with the fleet, the fifth ship being at the navy yard for its annual overhauling. The "California" and the "Pennsylvania" will be practically identical in size, speed, armor protection, and armament, and, therefore, they will form a group having the same speed and general maneuvering qualities. Although, when they are all completed, they will be alike in all military particulars, it will be easy to distinguish the two classes by the shape of the bow.

Electricity

Argentina Demands Electrical Supplies.—A call for electrical supplies has come from Buenos Ayres, Argentina. Owing to the war the stock of electrical goods has been greatly diminished, and there is an immediate demand for new supplies. The call comes from a representative of the Chicago Association of Commerce which maintains an exhibition of articles, manufactured by its members, in Buenos Ayres.

Whitewash and Electric Wiring.—A correspondent has sent us a clipping from a local paper describing a curious effect that resulted from whitewashing a barn. The whitewash contained a strong percentage of salt, which caused it to dry very slowly. The salt crept through the wiring of the electric light lines and also those of the telephone company, forming a short circuit which burned out a large place in the ceiling when the lights were turned on. The salt formed a conductor that extended to practically every piece of metal in the barn, as is shown by the fact that light shocks could be obtained by touching them.

Storm Detector for a Central Station.—The weather has a great deal to do with the demand for electric light. Hence it is necessary for an electric service company to keep an eye on approaching storms, so that preparations may be made for a coming spell of darkness. Recently, a company in New York has installed a storm detector similar to wireless telegraph receiving apparatus which is affected by neighboring thunderstorms and announces their presence by ringing a bell. The nearer the storm the more frequently does the bell ring, and within an hour to a half hour before the storm breaks, the bell rings continuously. Thus there is ample warning to prepare additional generators for service when abnormal demands for current are felt.

Tungsten Lamps vs. Gas Mantles During the War.—The keen competition, in some localities, between gas and electric lamps is liable to be affected materially by the present European war. Thorium, which is an essential constituent of the gas mantle, comes chiefly from Germany. Now that this source of supply has been cut off, manufacturers of gas mantles will be seriously crippled as soon as their present stocks of this rare earth are exhausted, unless the war comes to an end before that time. Manufacturers of electric lamps will no doubt make use of the opportunity to replace the gas mantles with tungsten lamps. The critical condition of gas mantle manufacture is indicated by the fact that efforts are now being made to save the ash from broken and burned-out mantles, so that the manufacturers may reclaim the thorium contained therein.

Electricity in Coal Mines.—In a paper read before the British Association in Australia, Dr. W. M. Thornton gave a summary of his investigations of electricity in coal mining. He studied particularly the limit of electrical ignition of mine gases and coal dust, and found that electric bells are apt to produce sparks at the trembler or at the push button, of sufficient intensity to ignite the gases. He arrived at the conclusion that all electric lamps, fuses, etc., no matter what their size, should be enclosed. However, all sparks are not of sufficient intensity to ignite the gas. For instance, the blue brush discharge from high pressure conductors will not light the gas, nor was he able to produce ignition with static discharges from a high speed belt. He also arrived at the conclusion that nothing was to be feared underground from wireless telegraph operation on the surface, as no dangerous sparks are induced therefrom.

Electrolytically-Produced Luminosity.—In a paper, recently read before the Royal Society, says the London *Electrician*, Mr. L. H. Walter took up the conditions under which it should be possible to make practical use of the luminosity of anodes of alloyed aluminium forming part of a "valve" cell arrangement. The alloy known as "duralumin" is found to give the best results, and, with sodium tungstate solution as electrolyte, corrosion is practically eliminated when this alloy is used as the anode. The difficulties with immersed anodes led the author to employ anodes which are completely dry, except as regards the front surface, which is kept wetted by means of a layer of electrolyte caused to flow down it in a continuous stream, the flow being distributed by using a transparent crêpe screen which clings to the anode surface. In this way, the anode being dry at the back, electrical connection can be directly established there, without the great care as to insulation otherwise needed. This arrangement permits of the construction of an apparatus having a multiple anode, comprising a vast number of equal units in quite a small compass, each such unit being capable of being rendered luminous in any order or sequence desired and at a speed of some hundreds of times per second. In the author's experimental apparatus there are over 5,000 such separate units in a space the size of a cabinet photograph—a number which it would hardly be possible to obtain by other means. Such an apparatus is capable of being employed as a receiver for photo-telegraphy for the reproduction of pictures, etc., especially where these are received as electrical impulses.

Science

A New Comet Discovered.—Word has been received that a new comet visible to the naked eye was discovered by Prof. Clarence T. Haggerty, of the New Mexico College of Agriculture and Mechanical Art, East Las Cruces, New Mexico, on September 25th. This comet was located in R. A. 0. hour 5 minutes and Declination —45 deg. at 11.30 P. M. on the date of discovery.

Flowering Plants Above Snow-Line.—Investigations by Herr von Klebelsberg in the Tyrolese Alps have revealed the existence in that region of no less than 86 species of flowering plants above the snow limit, and of these 56 were found some 300 feet above the snow-line, while six occurred over 1,500 feet above. The highest species of all, the glacial Ranunculus, was met with at over 12,000 feet above sea-level on the Grossglockner. In another part of the Alps, viz., on the Finsteraarhorn, it has been found at nearly 13,900, the greatest height attained by a vascular plant in the Alps.

Smoky Air and Animals.—Whether live-stock is likely to suffer when living in the neighborhood of railroad yards, industrial plants and large manufacturing centers, was the question that the Leeds University proposed to Yorkshire farmers, and the answers showed the affirmative not only for animals but also as concerns grass and other plants. It appears that the growth of young stock is kept back under such conditions, and in the case of old stock or horses these are seen to require much more care and food than those which live in a pure air. Such effects on animals are due partly to the direct action of the vitiated air when taken into the lungs and on the other hand by the very poor quality of the grass that grows here, as it cannot develop under good conditions. Sheep raising is found to be specially difficult in these places, even impossible. Near Leeds, this had to be discontinued, for the wool was of very poor quality, besides being full of impurities of various kinds. Thus it appears that the same general rules apply to animals as to human beings under such circumstances.

Shackleton Starts for the Antarctic.—The European war has not prevented the Imperial Trans-Antarctic Expedition from embarking for the south, notwithstanding the fact that some of its members belong, as Shackleton himself formerly did, to the British Naval Reserve. When the reserves were mobilized at the end of July, Sir Ernest offered the services of the expedition, with its stores and provisions, to the Admiralty, but fortunately the offer was declined with thanks. The "Endurance," the ship of the Weddell Sea party, left the Thames August 1st and Plymouth August 8th, carrying part of the expedition to Buenos Aires. The "Aurora," which is to carry the Ross Sea section of the expedition, is now at Hobart, Tasmania, and will sail for the Antarctic about the beginning of December. Shackleton and the members of his staff who had not already sailed on the "Endurance" left England September 18th by mail steamers; half of the expedition sailing for Buenos Aires, and the other half for Tasmania. Their departure was delayed by the necessity of buying in England scientific instruments to replace those which had been ordered from Germany.

The Latest Disaster in the Arctic.—While a recent note in these columns concerning the Canadian Arctic Expedition was in the press, news was received that the survivors of the "Karluk" party had been rescued from Wrangel Island on September 7th, by the gasoline schooner "King and Wing," and transferred the next day to the revenue cutter "Bear," on which they reached Nome, Alaska, September 13th. Unfortunately, only a remnant of the party which went adrift on the "Karluk" last autumn has survived. Grave fears for part of the expedition which were aroused by Capt. Bartlett's narrative of last July have proved to be well founded. It will be recalled that when Bartlett left Wrangel Island, on his hazardous trip across the sea ice to Siberia to seek aid for his comrades, eight of the latter had not yet reached the island from the scene of the shipwreck, though it was hoped that they would do so later. These were: A. Forbes Mackay, surgeon; James Murray, oceanographer; Henri Beuchat, anthropologist; A. Anderson, first officer; Charles Barker, second officer; and seamen Brady, King and Morris. These eight men have never since been heard from. Mackay and Murray were both members of Shackleton's last antarctic expedition, and Murray was biologist of the Scottish Lake Survey, under the late Sir John Murray. Beuchat was a well-known French ethnologist. Further casualties to the expedition include the death from disease of George Malloch, chief geologist, and Bjarme Mamen, assistant geologist, and that of seaman Breddy from an accident. Malloch was attached to the Geological Survey of Canada, while Mamen was a Norwegian. The men rescued from Wrangel were: Wm. McKinlay, meteorologist and magnetician; John Munro, chief engineer; B. Williamson, second engineer; R. Templeton, steward; J. R. Hadley, carpenter and dog-driver; Maurer, Williams, and Chafe, of the crew; and an Eskimo, with his family.

Aeronautics

Stabilizer for Hydro-Aeronautical Apparatus.—Charles Denniston Burney, of Killmeston, Alresford, England, has secured patent, No. 1 107,260, in which he seeks to enhance the stability of hydro-aeronautical apparatus, particularly during certain stages of transition from the hydro-volant to aero-volant condition.

Heating the Gas Container from Exhaust.—In the patent, No. 1,108,770, to Daniel Lopez and Mike R. Lerma, of San Bernardino, Cal., hot air is utilized for keeping the machine suspended in the air, and the exhaust from the motors maintains the sustaining gas in a heated condition.

Automatic Balancing Features.—In the aeroplane, patent No. 1,107,494, John Q. Chase, of Dayton, Ohio, is provided a balancing feature so constructed that the movement of the machine from level or normal position will automatically bring the balancing features into action by which the machine will be returned to normal position.

Week-End Aviation Meets at Hempstead.—Under the auspices of the new Week-end Meet Association, there has been flying, Saturdays and Sundays, for the last three weeks, at the Hempstead Plains Aviation Field. Races, bomb dropping and fancy flying have been indulged in. The meets will continue throughout October. They offer an opportunity for those interested in aviation to see the latest machines performing at their best.

The Aeronautical Society's Race Around New York.—Encouraged by the success of the race around New York city, which was held in conjunction with the Times last fall, the Aeronautical Society plans to hold another similar event on Columbus Day, October 12th. In all probability, even more machines will compete this year than the half dozen that successfully flew the 40-mile course in 1913.

A Glenn Curtiss Flying Machine Patent.—Mr. Curtiss, in a patent, No. 1,108,490, seeks to provide novel constructions by which to obviate the objectionable effects of side wings particularly those to which flying machines are often exposed when at rest and which tend to cause a lifting pressure beneath the lateral portions of the main supporting wings at the windward side of the machine and either turn the machine over or bring about undesirable strains.

The Sikorsky Machine in War.—We receive advices from abroad that the Sikorsky machine, recently described in the columns of the SCIENTIFIC AMERICAN, was used by the Russians in reconnaissance, at the very commencement of hostilities. It is said to have been brought down by the German fire. This would not be difficult if the machine were flying reasonably low, because of its slow speed. It can hardly make more than forty to forty-five miles an hour.

Patents for Aeroplane Guns.—Cleland Davis, U. S. Navy, has secured three patents, Nos. 1,108,714-715 and 716, relating to the firing of projectiles from aeroplanes, patent No. 1,108,714 being for an aeroplane gun having special construction for operating in connection with the recoil, while patent No. 1,108,715 is for an apparatus for firing projectiles from aeroplanes, and No. 1,108,716 is for another apparatus for firing projectiles from aircraft. A patent, No. 1,108,717, has issued to the same parties for fixed ammunition for use on aircraft.

A New Military Aeroplane.—A new type of military aeroplane, designed by Glenn H. Curtiss, has been tried out at San Diego, Cal., and developed remarkable speed and climbing ability. The new machine has wings shaped like those used on the flying boat America, the under surfaces being almost flat while the upper faces are highly arched, with a wing spread of over forty feet. The official requirements were that a weight of 600 pounds of useful load should be carried at a speed between 45 and 70 miles an hour, and climb at least 3,000 feet in ten minutes. It must also be able to rise from long grass or harrowed ground. In the trials all of these requirements were easily exceeded, although the engine was rated at only 90 horse-power, and a speed of 86 miles an hour is said to have been attained.

Studying Atmospheric Perturbations in an Airship.—The pitching and rolling of a dirigible balloon afford interesting information regarding the waves, eddies, and other perturbations in the atmosphere. The committee on dirigibles of the Aéro Club de France has recently drawn up instructions for observing and recording these movements for the benefit of meteorology. The committee recommends that every airship be equipped with a "clino-barometer," i. e., a clinometer, for indicating the inclination of the vessel to the horizontal, combined with a barometer, for showing the elevation. Both instruments trace a continuous record on a moving sheet of paper. There are two additional pens; one to record the time by marking minutes, and the other, at the control of the aeronaut, for marking more definitely any particular instant at which some phenomenon has been noted. While such observations are in progress, the pilots are expected to refrain from using the stabilizing apparatus of the airship more than necessary.

Laying the Aqueduct Siphon Across the Narrows to Staten Island

New Method of Making Flexible Yet Water-tight Joints

THE last gap in the great 120-mile aqueduct that is to bring mountain spring water from the Catskills into New York is now being closed. This is the 36-inch siphon running under the Narrows from Bay Ridge to Tompkinsville, Staten Island, and in many respects it is the most interesting work of the whole aqueduct system, for an entirely new method is being pursued.

The siphon is, roughly, 10,000 feet long, and must run directly across the main ship channel entering the harbor of New York, at a place where the tidal currents are swift and very difficult to contend with. In these busy and exposed waters, at the depth at which the aqueduct must be laid (about sixty feet below the mean sea level), it is impracticable to conduct diving operations. Consequently, a plan was worked out by which the siphon could be laid without the aid of divers. Our frontispiece illustrates the method that is being employed. The pipes are being connected above water with flexible joints, so that they may run down a launching cradle or skidway, and the joints are of such a character that no calking will be required after the siphon has been laid.

At first thought this might lead to some apprehension on the part of the public lest the joints might not be absolutely tight and the drinking water be contaminated by leakage. It may add to their consternation, particularly of those who dwell in Staten Island, to know that the siphon leaves the Bay Ridge shore right beside the outlet of a large sewer. But a moment's reflection reminds us that the water flowing through the siphon must rise to Silver Lake in Staten Island, which lies at a height of 225 feet above sea level. Hence, the water must have a head of at least 225 feet, or 97 pounds per inch more than the surrounding water, at every point along the siphon. Obviously the danger is not that water may leak into the pipe line, but that it might leak out, and with a line 10,000 feet long the leakage might amount, in the total, to a very considerable loss. Hence, the pipe joints have received most careful attention, to make them absolutely tight and yet flexible enough to slide down the skidway and adjust themselves to the more or less uneven bottom. Flexible pipe lines have been laid before without experiencing difficulty with the joints after they had been rendered tight, owing to the fact that the line in sinking into the mud puts a tension on the joints; it is an easy matter to preserve water-tightness as long as the joints are under tension. But in this case, with a line 10,000 feet long, far longer than any other submarine line we know of, it cannot be assumed that all the joints will be constantly under tension. In fact, it is safe to assume that many of them will not be under tension, and one of the main difficulties encountered in designing the form of the joint was to provide for flexibility and yet water-tightness under all the conditions the line will be subjected to when it assumes its final position in the bed of the Narrows.

The pipe sections are 12 feet long, with an internal diameter of 36 inches. Each section is formed with a spigot at one end and a bell at the other, the space between the spigot and bell being filled with lead, so as to form a ball and socket joint. Fig. 1 shows a section of the wall of the pipe at the joint. The bell is turned and ground to a sphere in which a variation from perfect sphericity of only 0.006 inch is allowed. The end of the spigot is formed with a collar turned to fit the bell accurately, while the outer surface of the spigot is formed with shoulders or annular ridges between which are recesses, in which the lead that fills the joints will be retained. It takes about 330 pounds of lead to fill the space between the bell and spigot. But, on cooling, this, of course, shrinks. It has been customary heretofore to close such joints by calking after the pipe is laid, but as divers could not very well be used on this siphon, a method was sought which would insure a perfectly tight lead joint before the pipe was lowered into the water. As a result of a workman's suggestion, it was decided to introduce slugs or "pellets" of cold lead into the lead filling after it had hardened, and by forcing in the cold lead to expand the lead filling until it came into intimate contact with the surface of the bell. Threaded holes were formed in the bell, through which the lead pellets were introduced and forced in by means of gib screws. A great deal of difficulty was experienced first, owing to the tendency of the spigot to move out of the bell slightly when the lead was introduced. But after much experimentation, which consisted chiefly in varying the location of the annular ridges on the spigot and the holes through which the lead slugs were introduced, the difficulty was overcome. The form of spigot finally adopted is that shown in Fig. 1.

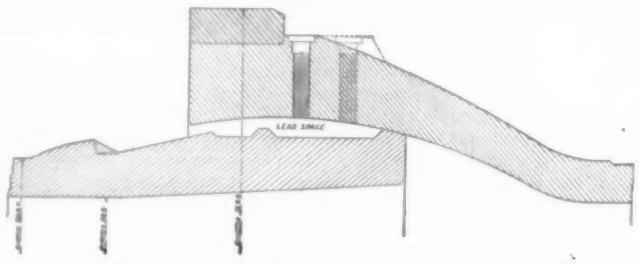


Fig. 1.—Longitudinal section, showing the construction of the flexible joint.

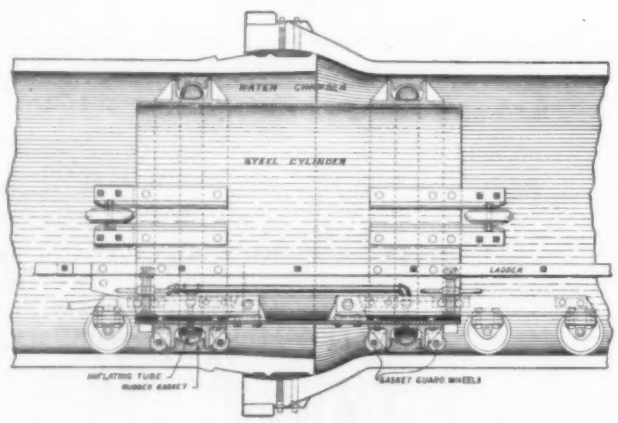


Fig. 2.—Apparatus for testing the joints of the siphon.

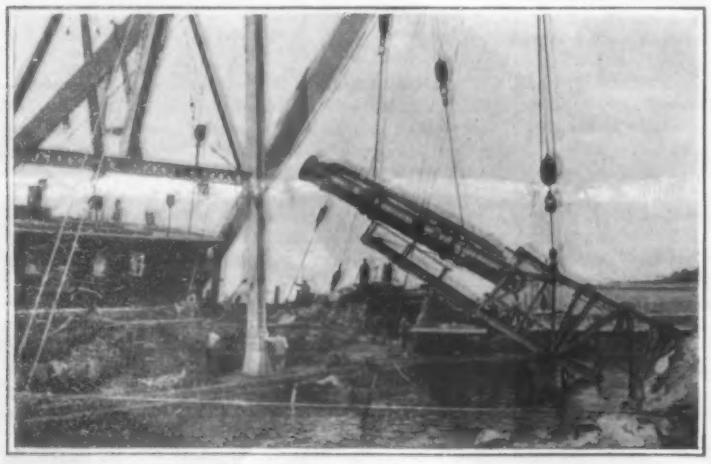
There are thirty-two holes in each bell, arranged in two staggered rows. The joint is cast in the launching cradle. After the lead has been poured a frame is mounted on the pipe, and this carries four pneumatic tools with which the gib screws that close the holes in the bell are unscrewed and removed. These tools operate at four points equally disposed about the periphery of the bell. After the gib screws have been removed, the lead pellets, which measure 9/16 of an inch in diameter by 1¾ inches long, are introduced into the hole, and then the gib screws are screwed in again to force the pellets into the cast lead. Altogether it takes about twenty-two pounds of cold lead to fill the shrinkage space. Three pellets are introduced into each of the upper holes and four into the lower ones, and the gib screws are forced far enough into the cast lead to form a depression into which a mixture of graphite and grease is introduced. Then the gib screws are replaced by permanent screw plugs which force the lubricant into the joint. This done, the pipe section is oscillated, to be sure that the joint is flexible, and thereafter it is subjected to a hydraulic test to determine its tightness.

The hydraulic testing apparatus is shown in Fig. 2. It consists of a cylinder mounted on wheels, which is lowered into the pipe until it comes to the joint. Surrounding each end of the cylinder is a dam, consisting of a rubber hose similar to an automobile tire, which bears against a rubber gasket. When water is introduced into the hose it is inflated, forcing the gasket tightly against the inner wall of the pipe. At the same time water is introduced into the space between the cylinder and the pipe and raised to a pressure of 100 pounds to the square inch. This pressure is retained for a period of ten minutes, while the joint is watched to see whether any leakage occurs. Originally it was proposed to use a pressure of 200 pounds per square inch, but it was found that this would not give a fair test, for it actually resulted in tightening the joint by producing a longitudinal movement of the spigot with respect to the bell. With the lower pressure there is practically no such movement.

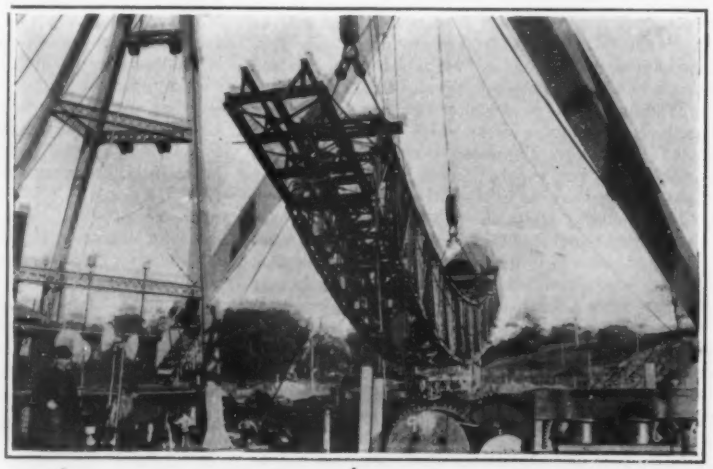
As shown in our illustration, the skidway consists of a bridge truss, the panels of which are connected one to the other at an angle of 5 degrees, so as to produce a curved launching way. This passes down under the pipe-laying lighter with its lower end dragging in the trench in which the pipe is to be laid. As the skidway is very heavy, a buoyancy cylinder has been secured to the after end, to prevent it from sinking deeply into the mud of the harbor bottom. This cylinder, although not shown in our front page illustration, may be seen in one of the photographs.

It will be realized that it is very necessary to keep the lighter in true alinement with the trench. For this reason ten anchors are used on cables from a thousand to twelve hundred feet long, there being two forward, two aft, and three at each side. The cables lead to a system of power-operated drums. When a joint has been completed and tested, the lighter is moved forward by taking in on the forward cable and letting out on the after ones, until the bell on the section just connected is lowered to a convenient position to receive

(Concluded on page 310)



Lowering the first three sections of the siphon into the launching cradle.



Lowering the launching cradle. Note the buoyancy cylinder.

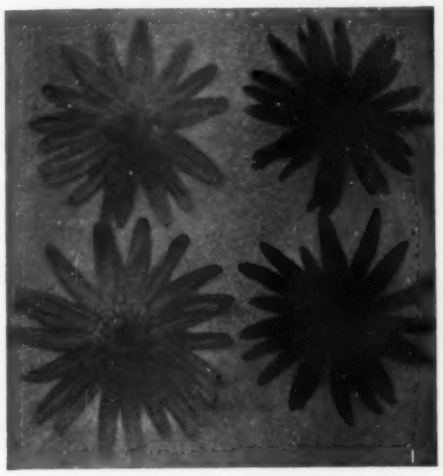


Fig. 1.—Chrysanthemum, a normal flower, shows black in ultra-violet light.

Flowers Photographed With Invisible Light

High Reflecting Power for Ultra-violet Rays of Certain Yellow Blossoms

By G. Michaud and F. Tristan, Costa Rica State College

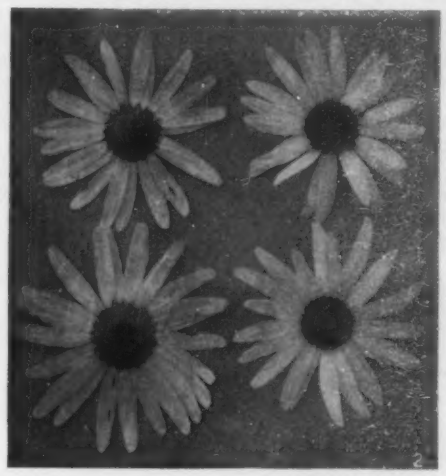


Fig. 2.—Same as Fig. 1, but in visible light. The chrysanthemum shows white.

PROF. WOOD was first to note that some white flowers appeared with black petals on photographs made in ultra-violet light of some 3,200 Angstrom units. On a photograph of honeysuckle, white phlox, and geranium, published in the November 15th, 1913, issue of the SCIENTIFIC AMERICAN, Prof. Wood observed that while the petals of both phlox and honeysuckle came out dead black those of geranium were lighter in tone. The writers have repeated and extended those researches to a total of ninety-seven flowers representing the most important families and many shades of red, yellow, blue and violet, besides pure white. They came to the conclusion that, with the exception of the few yellow flowers which will be described further under the name of ultra-violet flowers, differences in the absorption of ultra-violet light by petals are small when compared with the almost general high absorbing power of corollas of all color for these radiations. Flower after flower, whether white or colored, left a black or dark gray image on the photograph made through Foucault's silver film, while, in visible light, they came out, as could be expected, in widely different shades. For some time the writers were even led to believe that a strong absorption of ultra-violet light was quite a general law among corollas, until it happened that one yellow flower, *Cucurbita Pepo*, the common squash flower, came out on the positive with a pure white tint. Such was the contrast with all previous photographs of other flowers that it was for a moment considered as the result of an involuntary substitution of the ordinary objective to the silvered quartz lens. Further work brought out similar flowers, all of them yellow, the list of which follows: *Cucurbita Pepo; Leontodon Taraxacum* (Dandelion); *Cassia Pubescens; Tithonia Speciosa; Cucumis Sativus; Sonchus Oleraceus; Spilanthes Parvifolia; Sida Rombifolia; Oenotera Sp; Oxalis.*

For these abnormal corollas the writers propose the name of "ultra-violet flowers," which recalls their high reflecting power for ultra-violet light as contrasted with the high absorbing power of all other flowers, whether colored or white, in similar circumstances. All ultra-violet corollas, so far, are yellow, but most yellow flowers are not ultra-violet and come out, on photographs made in ultra-violet light, as normal flowers do, that

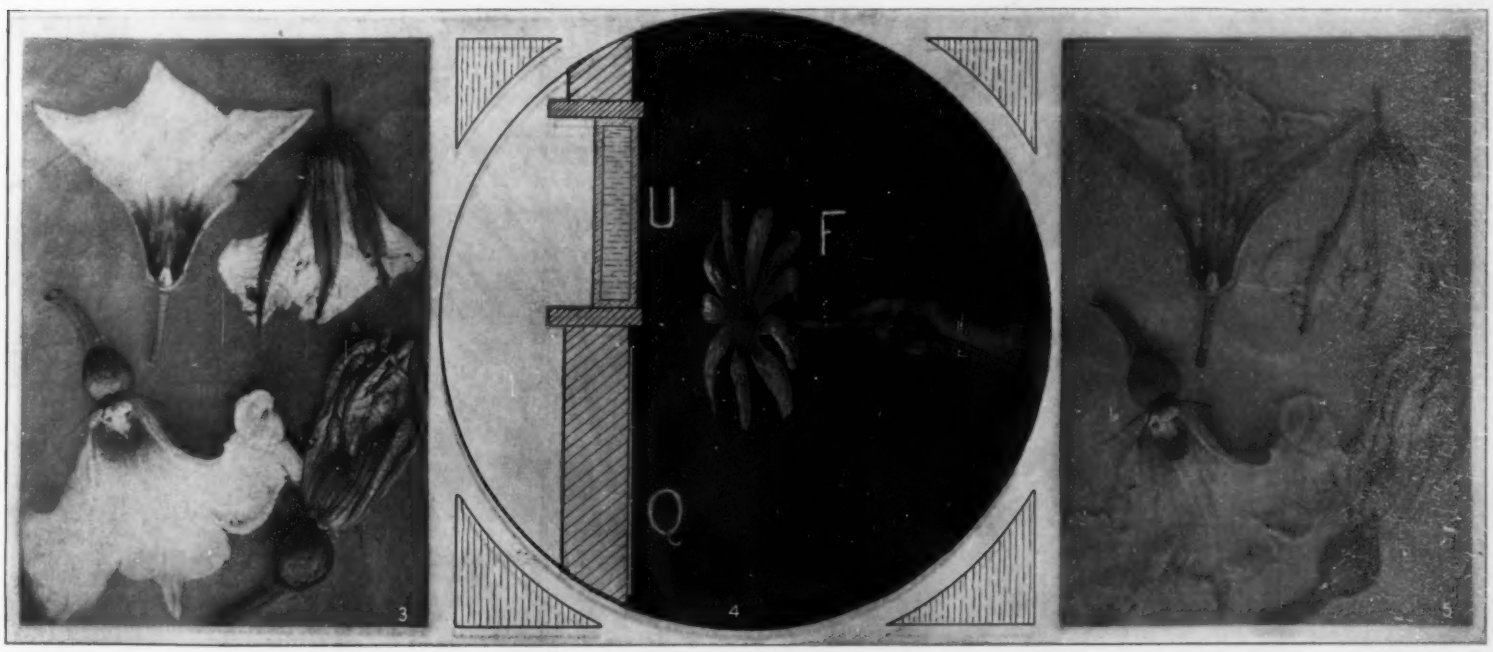


Fig. 3.—Common squash, an ultra-violet flower, shows white in ultra-violet light, but (Fig. 5) dark in visible light. Fig. 4.—Handy method of detecting ultra-violet flowers.

Fig. 6.—Three specimens of an ultra-violet flower (Tithonia Speciosa) among normal flowers. Fig. 7.—Same, photographed by visible light.

Fig. 8.—Ultra-violet photograph in which "Cassia Pubescens" is conspicuous. Fig. 9.—Same, photographed by visible light.

is, as dark patches. Nothing in the visible color or appearance of yellow flowers allows of any distinction between the yellow-ultra-violet and the yellow-black flowers. In both classes several shades of yellow, from the orange to a greenish yellow, are found.

The strong absorption of ultra-violet light by most corollas perhaps affords protection to the ovary and stamens. Such a protection is given to our own tissues by the pigment contained in the skin, and where pigment is scarce sunstrokes are likely to occur. Ultra-violet light rapidly destroys many unprotected organisms such as microbes, and Guilleminot has shown that short wave length radiations are particularly harmful to ovules. If it be considered that most corollas not only reflect, but moreover concentrate light upon the ovary and stamens the necessity of a sifting of the radiations and of the elimination of short wave lengths becomes most evident.

As to the abnormal ultra-violet corollas, it is interesting to note that among those of the *composita* family, only the exterior corollas, so far, are ultra-violet. The interior flowers come out black on the ultra-violet photographs, although they may be apparently just of the same yellow color as the outside peripheric corollas. In ultra-violet flowers of other families, light is reflected under such an incidence as to make it probable that its destination is the outside rather than the inside of the flower. From such facts it may be inferred that the function of the ultra-violet light reflected by the abnormal corollas is perhaps the same as that of visible colors, i. e., to attract those insects which play an important part in fertilization. The fact that our own retina does not perceive ultra-violet light is no good proof against that hypothesis. All retinas are not made upon the same plan nor are probably adapted to one and the same scale of wave lengths.

While photography is, so far, the surest guide in the detection of ultra-violet flowers, the writers found recently that another method can be successfully used for the same purpose. Owing to the great difference in the reflective power of normal and ultra-violet corollas for ultra-violet light, an ultra-violet flower, placed in the path of a beam of ultra-violet light, in such a position as to reflect most of the invisible light upon a sheet of white paper moistened with a solution of acid quinine sulphate, causes this alkaloid to become highly luminous, while nothing is observed with a normal flower, whether white or colored, in the same circumstances. When the experiment is made as shown in the accompanying figure it is always very successful. In a dark room, a circular hole is made in the shutter. With the help of a pasteboard tube, a Zeiss Uviol filter *U* (Uviol glass cell containing a copper sulphate solution) is placed in the path of a beam of light coming from the blue sky. *Q* shows the position of the white paper which has been previously moistened with a solution of quinine sulphate to which a few drops of sulphuric acid have been added; *F* that of the flower. The selection of the most favorable incidence for the flower is made easy if the experimenter takes the trouble of waiting from 15 to 20 minutes in the darkness before beginning work. Owing to the powerful adaptation of the retina for small wave length radiations, part of the ultra-violet light becomes then visible and the Zeiss filter is perceived as a violet disk.

A study of the vertical distribution of ultra-violet flowers might reveal interesting facts, as sunlight at great altitudes not only is richer in ultra-violet radiations, but contains moreover wave lengths which are not found at sea level.

These curious phenomena led us to seek what becomes of the selective reflection of flowers in the opposite end of the spectrum, that is among the great infra-red wave lengths. For that purpose we resorted again to the photographic method and used one of the filters proposed by Prof. Wood and made by Messrs. Wratten and Wainwright of Croydon, England (a yellow film cemented between two dark cobalt glass plates). The first radiations admitted by that filter are found in the neighborhood of 7,400 A. U. On the other hand, the last radiations which affect a plate sensitized with alizarin blue *S*, ammonia and silver nitrate, stand at about 9,500 A. U. Hence it may be stated that the accompanying photos of corollas were made exclusively by those extreme red and infra-red radiations extending between 7,400 and 9,500 A. U.

While the total number of flowers thus photographed is not large (43), the remarkable uniformity of the results so far obtained with corollas of every color, leads us to believe that the great differences in the reflective power of flowers, for those wave lengths which correspond to visible and ultra-violet lights, come to an end, almost abruptly, in the invisible infra-red. Between 7,400 and 9,500 A. U. corollas of every color reflect most of the radiations which strike them, and, so far as we could observe, do not practise on them the intense selective absorption which causes the beautiful colors of flowers in visible light. If our eye were sensitive to every one of the radiations found in sunlight, flowers of all colors, when illuminated by the beginning of the infra-red exclusively, would probably give us the impression of a highly luminous white.

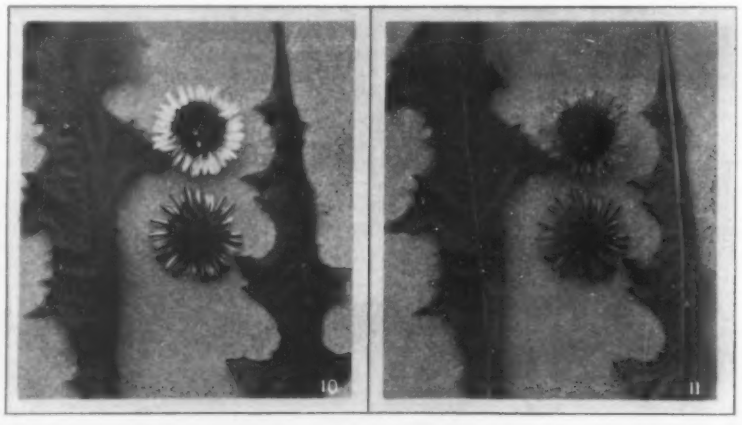


Fig. 10.—Ultra-violet, and, Fig. 11, visible light photographs of the upper and lower faces of a dandelion.

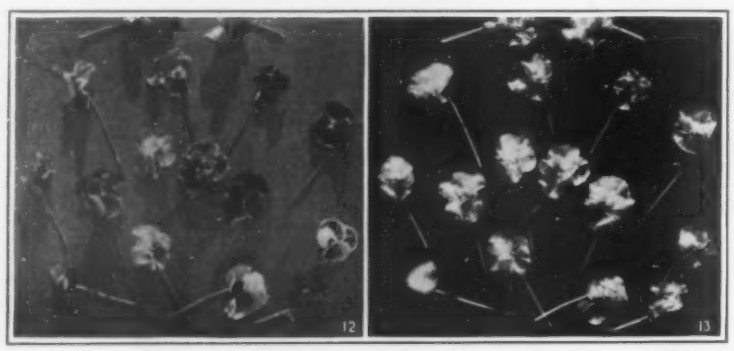


Fig. 12.—Visible light photograph of seventeen varieties of pansies.
Fig. 13.—The same, in infra-red light.

Coal-tar Dyes

THE present crisis in Europe has practically cut off the supply of coal-tar dyes which this country has been importing from Germany, France, and Great Britain, and the question arises, can the United States manufacture a sufficient quantity of these dyes to meet the demand? Another point to be considered is the return to be expected on the capital invested should the United States succeed in transplanting the artificial dyestuff industry from Germany to this country.

There are to-day in the United States nine factories which produce coal-tar dyes, but these factories are dependent upon Germany for the raw material they employ. A sufficient quantity of coal-tar could be produced here to render the aniline dye industry independent of the foreign tar supply, but the domestic producers of such raw materials can obtain higher prices for them from other sources than the artificial dye industry could pay.

As Dr. Bernhard C. Hesse pointed out in a lecture at the College of the City of New York, on May 1st, 1914, "Germany is supreme in the coal-tar dye industry, because (1) Germany was the home of the industry; (2) the industry itself is so dependent upon interlocking chemicals and the growth of this interlocking dependence has been as fast as economic development warrants and has now reached such a stage of complexity and interdependence that it is difficult of transplantation as a whole; (3) there are relatively few so-called staple articles among the coal-tar dyes—by staple is meant those which are consumed in quantities to be measured by tons—many of those few are so interlocked with subsidiary or by-products that the transplantation of the work out of Germany would be economically unprofitable. Wherever it has been profitably transplantable to this country, the manufacturing of such staples has been done, and with considerable success, even though the raw material supply is still provided by Europe."

In 1912 Germany had a total of 5,319 stock companies of which twenty-one operate coal-tar dyestuff works. The capital stock of the combined companies is 146,800,000 marks, and they paid 46,000,000 marks in dividends in 1912, which amount to 21.74 per cent of the capital stock. Ninety per cent of the coal-tar dyestuffs manufactured in the world are made in Germany, and Germany has three dollars' worth of such dyestuffs to sell for every dollar's worth that she needs at home.

The coal-tar dye industry, if transplanted to the United States, must be prepared in the very beginning to manufacture 700 different and distinct dyes. Dr. Hesse has said that this would call for an initial outlay of approximately $50,000,000 in cash. To begin the industry with the production of 700 different aniline dyes would necessitate the introduction of 700 different sets of operations and about 350 different sets of apparatus. The entire United States consumption would not employ more than 7,000 persons and represents about 0.4 per cent of our total import business.

The possibility of the United States' competing with Germany in the manufacture of artificial dyes has been carefully considered by both capitalists and chemists long before the present emergency, say for the past 30 years. The industry has been developed in Germany to such an extent and refinement that Germany is wholly independent of sources outside of her own boundaries. While no one of the German factories is entirely independent of the others, taken collectively, they are not dependent upon anything outside of German soil. It would not be possible to duplicate elsewhere the conditions in Germany over night. To produce a complete and self-contained artificial dyestuff industry in this country and to produce it at once would call for the investment of capital far in excess of what the distant dividend would seem to warrant. To plan and erect the necessary buildings and machinery would require a full year.

During 1913 the total importation of artificial dyestuffs into the United States has amounted to $7,105,284. This was exclusive of alizarine dyes and indigo. During the census year of 1910 (the latest available figures) this country manufactured $3,462,436 worth of artificial dyestuffs, about 32 per cent of the country's consumption of aniline dyes, but the bulk of the raw materials used in the manufacture of those aniline dyes in the United States is obtained from Germany and England. And until the United States can be sure of producing the necessary raw materials at a price which will enable the color industry to purchase them here and still be assured of a reasonable profit on the finished product, the financial aspect of developing the coal-tar dye industry to the point where the United States can supply her own needs will remain questionable.

In the past thirty-six years there have been taken out in Germany 8,062 patents on the utilization of coal-tar hydrocarbons and their by-products. Out of these but one in every hundred, it is authoritatively said, has secured financial returns for its owners. Not all the work on coal-tar dyes which has been done in Germany has been profitable. But out of the years of painstaking research work and aggressive merchandising has grown an industry which is second to no other of its kind in the world.

American brains and American capital doubtless could develop a coal-tar dye industry which could supply the requirements of this country in artificial dyes, and possibly compete with Germany in exports, but the return on the capital invested would not be sufficiently attractive in comparison with the return which might be obtained in other fields that it would not be desirable to attempt it. And one other thing must be considered, namely, when the present war is over Germany will make every effort to regain the ground she has lost industrially and would undoubtedly sell at a very close margin, possibly at figures which would make American competition unprofitable, if not impossible.

To Harden the Surface of Concrete Floors

CONCRETE floors in factories do not always stand the wear, so that the new treatment now current in England should become better known here. A mixture of 15 or 20 pounds of iron dust or flour with 100 pounds of cement is added to twice that much sand and applied as a top coat, nearly an inch thick. It is said to be hard, very durable for heavy wear, waterproof, and not slippery.

Our Merchant Marine, Past, Present and Future

II. The Present

By Winthrop L. Marvin, Author of "The American Merchant Marine. Its History and Romance"

A PREVIOUS article has outlined the notable growth of the American merchant marine in overseas trade from the first navigation acts of Washington onward, the fluctuating tonnage of the years between 1828 and 1855, and the long decline that followed. When the great European war broke out last month, the American tonnage registered for overseas carrying was 1,019,165, or an amount scarcely greater than the 981,019 tons of one hundred and four years ago—1810. But even this figure of 1,019,165 tons is deceptive. It includes a great many small craft that perform what is practically a ferry service to Canada or ply upon international rivers like the Yukon. It includes, moreover, many large ships that have been engaged in coastwise commerce by way of the isthmuses of Panama and Tehuantepec, or *via* the Strait of Magellan—ships that will now pass through the Panama Canal. These vessels convey cargoes that are chiefly or altogether American, between the Atlantic and Pacific ports of the United States. Because these voyages carry them by the shores of foreign countries, they find it convenient to sail under foreign trade register instead of coastwise enrollment. Besides, there are other vessels engaged only casually or for a part of the year in foreign commerce.

It is probable that all American shipping, steam and sail, employed regularly and exclusively in overseas traffic with other nations would not now exceed 600,000 tons. This tonnage sufficed in the last fiscal year to carry only 8.9 per cent of the seaborne commerce of the American people, or a value of only $381,032,495, as contrasted with $3,392,028,429 conveyed in foreign ships under the flags of foreign governments. The cost of carrying the mails, passengers and merchandise in the import and export trade of the United States is estimated conservatively at between $200,000,000 and $300,000,000 a year. At least nine tenths of this vast sum is engrossed by the shipowners of Europe and Japan, stimulating the shipbuilding and navigation of our rivals in trade and possible enemies in war, who are thereby enabled to maintain their auxiliary navies in large part at our expense. In our time of need, we have just seen how quickly these alien auxiliaries leave us—ships and men alike.

Existing American steamship services to foreign ports beyond those immediately adjacent to our ports are so few that they can easily be enumerated. First, there is the American Line to Europe—four steamers, the "New York," "Philadelphia," "St. Louis," and "St. Paul," subsidized for carrying the United States mails under the law of 1891. Then there are two steamers of the Red Star Line, the "Finland" and "Kroonland," built in anticipation of the passage of the Frye-Hanna subsidy bill of 1901-1903, transferred for economy of operation to the Belgian colors, and since brought back to the American flag for prospective coastwise service through the Panama Canal. Six ships thus make up the whole American fleet regularly employed in scheduled service to European ports.

In the trade to the West Indies and the Caribbean region, the Stars and Stripes hold a position of some dignity and power. The New York and Cuba Mail Steamship Company (Ward Line) performs a postal, passenger, and freight service from New York to Cuba, the Bahamas and Mexico, with nine or ten American steamers of excellent speed and adequate tonnage. Like the American Line to Europe, the Ward Line is subsidized under the Ocean Mail Act of 1891. So is the Red D Line of four ships, from New York to Venezuela *via* Porto Rico. Our one government-owned steamship line, the Panama Railroad Company's service, has been operating seven steamers from New York to Colon. The Clyde Line operates two ships from New York to Santo Domingo. The Southern Pacific sends a few steamers from Gulf ports to Cuba. The United States Steel Corporation has been employing under charter three American ships of the great coastwise fleet of the American-Hawaiian Company, from New York to Brazil.

In the Pacific, five American steamers of the Pacific Mail run from San Francisco across the Pacific *via* Hawaii to Japan, China, and the Philippines. One American steamer of the Great Northern Company runs from Puget Sound to the Orient. The re-established service of the Oceanic Company or Spreckels Line, with three steamships, extends from San Francisco to Australasia. Smaller vessels of the Pacific Mail operate from San Francisco to Central America and Western Mexico.

This short list comprises the American steamship fleets actually employed in foreign trade on August 1, 1914. In addition, American sail vessels of a small though varying number are still employed in foreign voyages in the Atlantic and Pacific, and from time to time individual American "tramp" steamers of the coastwise fleet—a useful type and increasing—are chartered for cargoes overseas. But altogether, American participation in ocean commerce away from our own shores long has been and is so slight as to be a cause of mortification and loss to the United States.

It is significant that four of the few American steamship services to foreign ports—the American Line to Europe, the Ward Line to the West Indies and Mexico, the Red D Line to Venezuela, and the Oceanic Line to Australasia—are in the receipt of mail subventions or Government encouragement. The law of 1891, under which these lines are operating, is, therefore, responsible for the greater part of the present regular steamship service under the American flag to other countries. The Pacific Mail is maintained as a matter of pride or tenacity of purpose by the Southern Pacific Railway, which has long controlled it; for it yields no dividends, and can expect none, so long as it is paralleled by subsidized Japanese and British competition.

This Ocean Mail Act of 1891 has justified itself and would have been much more successful if the original rates of compensation—comparing not unfavorably with what is paid for similar service by foreign governments—had not been ruthlessly slashed on the enactment of the law by the insistence of the agricultural South and West in Congress. Every effort to restore the original rates, as recommended by Presidents Roosevelt and Taft, to provide new lines to South America and the Orient, has been defeated by narrow majorities in Washington, through blind and narrow opposition from the same sections to which the European war has at last brought a new realization of the national value of an American merchant marine.

Lacking national aid to overcome disparity in construction costs, wage maintenance costs, and foreign subsidies to swift regular services on many routes, American shipowners, though as enterprising and courageous as other men of their race, have not been able to increase our actual overseas fleet, even in past years of high national prosperity. Not one ocean ship has been built in the United States exclusively for foreign commerce since the "Saratoga" and "Habana" were launched for the Ward Line, in 1907. American shipbuilding and shipowning for the overseas trade have been, since then, an industry of absolutely arrested development.

This fact led to the inclusion in the Panama Canal Act of 1912 of a new departure in American maritime practice—the opening of American registry to foreign-built ships not more than five years old, to engage in foreign commerce. But though this free ship provision went into effect at a favorable period, when the ocean-carrying trade was generally active and profits were high, not one ship of any kind was brought under the American flag in consequence, thus demonstrating that a free ship experiment in itself is futile, without some more positive legislation to reinforce it.

Contrary to an impression which the foreign steamship interests carefully inculcate, the ocean-carrying business, as a whole, is a reasonably profitable business. Dividends of 7, 8, 9, 10, or 12 per cent have been paid of late years by some of the world's chief shipping companies. Foreign capital finds it advantageous to build and operate an increasing fleet of ocean ships, and, what is more, a very large amount of American capital, estimated at between $100,000,000 and $200,000,000, has been invested in the ocean trade, under foreign colors. The problem of the American merchant marine of the future is essentially how to make shipping yield returns under the American flag equal to those yielded under foreign colors. If great sums of American money are ventured in ownership and operation of foreign vessels over which our Government has no control, it stands to reason that under equalized conditions American money should even more easily be secured for ocean investment beneath the American flag, which could protect American property without explanation or embarrassment.

When the Congressional Merchant Marine Commission, of which Senator Gallinger was chairman, under President Roosevelt's administration, asked representative bankers and merchants of the seaboard if American capital were ready to embark in the ocean shipping business if the costs of construction and of operation could be equalized with foreign flags, the unanimous reply was that the requisite capital would be forthcoming. Since that time there has been an enormous increase in the capacity and value of our coastwise shipping, the branch of our merchant marine where fair profit is possible, and the new steamers of the Panama Canal fleet particularly have been built on designs adapting them to world-round service.

There is money enough in the country, and there are the men. A very great part of the American race is a sea-loving and seafaring race, by tradition and environment. It is not essential to the development of an American fleet in foreign trade, any more than it is to the development of any other national industry, that none but American citizens should be employed in the business. But the number of American citizens actually employed under the American merchant flag is very much greater now than twenty years ago. Then only 30 per cent of the shipments by United States Commissioners of crews of merchant vessels were of citizens of the United States. Now the citizen proportion so shipped has advanced to about one half, the native-born heavily predominating. In 1903 the American citizen shipments were 59,498; in 1913, there were 95,820.

A recent critical study of American ocean shipyards by a British observer has produced the judgment that these American yards stand in the very first rank, in the technical skill and executive ability of their staffs and the completeness of their equipment. The yards which built and engined the American battleship fleet in its around-the-world voyage—an exploit never attempted by so many heavy ships under any other flag—need no further encomium.

The United States has a vast foreign commerce of a value of four billion dollars a year, which could be swiftly and greatly increased if the nation possessed its own sea delivery wagons instead of depending upon jealous competitors for this vital service. A question of supreme importance to the American people is, How can American ships, the delivery wagons of the ocean, be most surely and quickly secured?

(To be concluded.)

Molding Brass Pieces

IN some of the modern European electric construction works, molding machines turn out millions of small brass pieces such as the industry requires. Compression of brass pieces in steel molds has now supplanted the old method of casting, for turning out such pieces in brass or bronze. Formerly a sand mold had to be made for each piece, but now a single steel mold serves for thousands of pieces. In this process are used brass bars whose section is chosen after experience so as to be best adapted for shape and size of the finished piece, then a section is cut off the bar to length, and the piece is heated to redness in a furnace, then molded at high pressure in the steel mold. A pressure of a few seconds is enough to produce the required shape, and it is found that pressure makes the brass more compact and solid. As the steel mold can be made exact to a small fraction of an inch, the products have very close sizes for use. Even pieces which formerly were cast in bronze, such as shaft bearings, are now made by the molding process.

The Current Supplement

THE current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2023, for October 10th, covers a wide field of information. The description of the "Parseval" airship, by a specialist personally familiar with its details, is particularly timely, as is also the description of the Rumpler monoplane, adopted by the German government. The article on Germplasm as a Stereochemic System disclosed a new line of research of intense interest. The discovery that the toxic principles of venoms of serpents are albuminous has led to the further discovery that these terribly lethal substances are proteins, and that, apart from their toxic properties, they are indistinguishable from corresponding bodies that are ingested as food or found as normal constituents of living tissues generally; and this time has led to the conception that in different organisms there are correspondingly complex organic substances which are not absolutely identical in chemical constitution, and which may exist in countless modifications, each characteristic of the form of protoplasm, the organ, the individual, the sex, the species, and the genus. Coal-tar Products in Medicinal Use tells interesting facts about same newer medicines, and the Physiological Standardization of Drugs is an interesting account of how the strength of powerful drugs is established, and the proper doses determined. Stress Distribution in Materials contains many valuable suggestions to all who are engaged in engineering projects, and there is also the usual selection of other interesting matter.

Coaling a United States Battleship

A Dusty and Dirty Task That is Rushed Through With Great Dispatch

ALTHOUGH the job of coaling ship is one of the dirtiest and most unpopular jobs that falls to the lot of a ship's company, it is always rushed through with energy, and haste is made with the holystone, the brush and the hydrant, to restore the much-begrimed ship to its chronic condition of spick-and-span order and cleanliness.

The matters of coal supply, coal capacity, and speed in coaling ship, are among the most important of those affecting the efficiency of a navy. No thoroughly satisfactory method for coaling ships at sea has been devised; that is to say, one that will enable a ship to be coaled in a sea-way, and hence it is necessary when bunkers have to be replenished to send the ship to some sheltered waters, where the colliers can lie alongside and put the coal aboard without any injury to collier or warship. This, of course, necessitates the ship's leaving its station with the fleet for a considerable length of time, with the result that the active line is temporarily weakened to that extent. Consequently, every effort is made, in the construction of the bunkers and the coal trunks thereto, in the appliances for transferring the coal from the collier to the ship, in training of the crew to shovel the coal from the deck to the trunks leading down to the bunkers, and rapidly to stow it, so that the whole operation of coaling may be got through with the least possible loss of time.

There is no navy in the world which has devoted so much attention to this matter as the United States Navy; and the department has designed a fleet of large colliers, of great coal-carrying capacity, good speed, and provided with the most modern coal-handling apparatus, which have served greatly to increase the mobility of our fleet, by rendering it less dependent on coaling stations.

Although coaling ship is an exceedingly dusty, dirty and uncomfortable job, calling for a large amount of subsequent cleaning up to make the ship presentable, there is keen competition among the individual ships of the fleet in the effort to obtain a high record for speed of coaling. As an instance of what may be done, we quote the case of the "Georgia," one of our earlier pre-dreadnoughts, which is credited with having stowed in her bunkers 468 tons in one hour, and the dreadnought "Arkansas," one of our latest ships, whose crew stowed as much as 560 tons of coal in the hour.

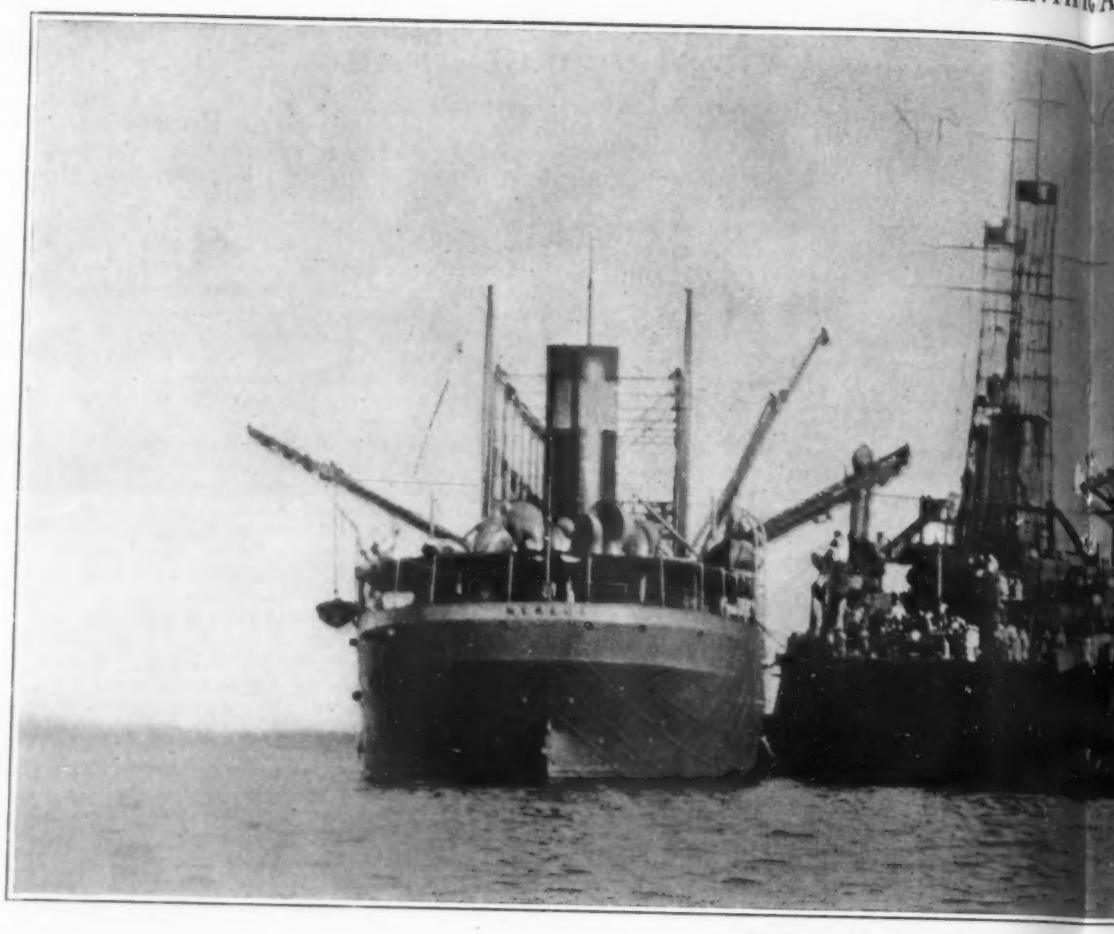
Previous to the year 1908, the navy possessed about a dozen extemporized colliers, some of which had been built in this country and some abroad. They were ships of moderate coal-carrying capacity and their coal-handling apparatus was of limited efficiency. Since 1908, the department has designed a very fine fleet of large colliers, equipped with the most modern coal-handling apparatus, which have increased the mobility of our fleet—a subject to which the Navy has given much attention. The first of these, the "Prometheus," has a capacity of about 6,000 tons of coal. This was followed in 1909 by the "Hector," "Mars," and "Vulcan," each carrying a cargo of 8,200 tons of coal. In 1910 and 1912, we built the "Cyclops" and "Jupiter," large ships of nearly 20,000 tons displacement and 14 knots speed, carrying a cargo of about 10,500 tons of coal and nearly 3,000 tons of oil. Of about the same capacity are the "Neptune," 1911; "Proteus," 1912; "Nereus," 1913; "Jason" and "Orion," 1914. All of these ships are of 14 knots speed, and they are equipped with the most up-to-date unloading gear. We have also under construction two oil fuel ships, the "Kanawa" and "Maumee," 14,500 tons and 14 knots carrying 7,564 tons of oil fuel.

When a warship is to be coaled, a collier, or two of them as in the case shown in our illustration, are brought alongside; the booms are lowered until they cover the warship coal trunks leading to the bunkers, and the delivery of coal commences and is carried on continuously until the full load has been delivered. The gear consists of a series of cableways, leading from the central A-frames of the collier out to a corresponding series of booms that are lowered above the warship. One-ton clam-shell buckets pick the coal up from the collier's hold, run it out over the warship and dump it into the chutes leading from the deck to the bunkers. Sometimes, when the unloading capacity of the collier is greater than the receiving capacity of the ship, the coal is deposited in large piles on deck, as shown in our photograph. The seamen turn to and shovel the coal down into the coal chutes, and a large force of trimmers in the bunkers below stow it snugly.

Sewing Broken Bones With Bone Pegs

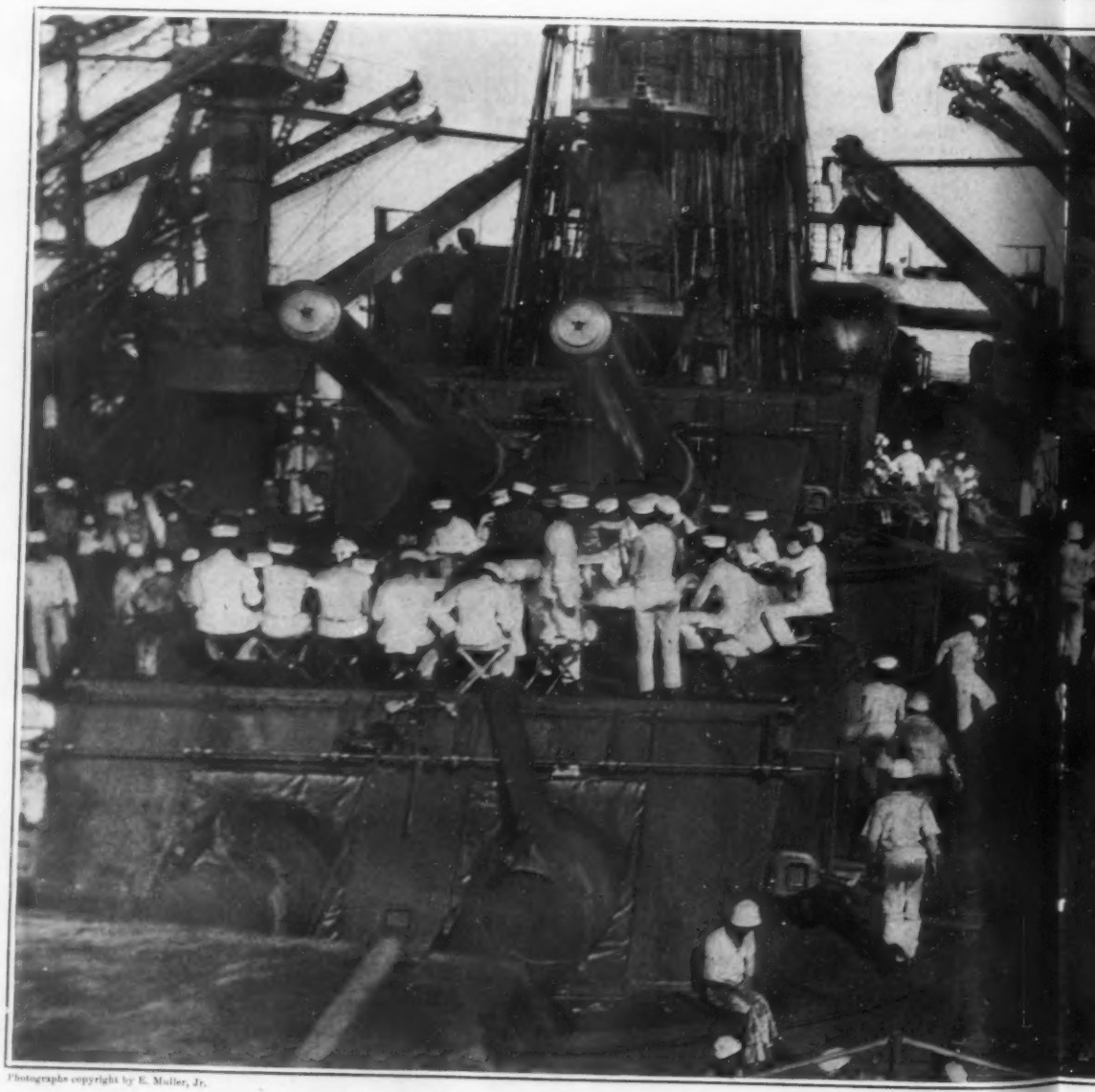
By Dr. Leonard Keene Hirshberg, A.B., M.A., M.D. (Johns Hopkins)

UNTIL a few short years ago there was no new thing under the sun as far as broken bones were concerned. When the Egyptian mummy cases were



The dreadnought "Arkansas" has a record of stowin

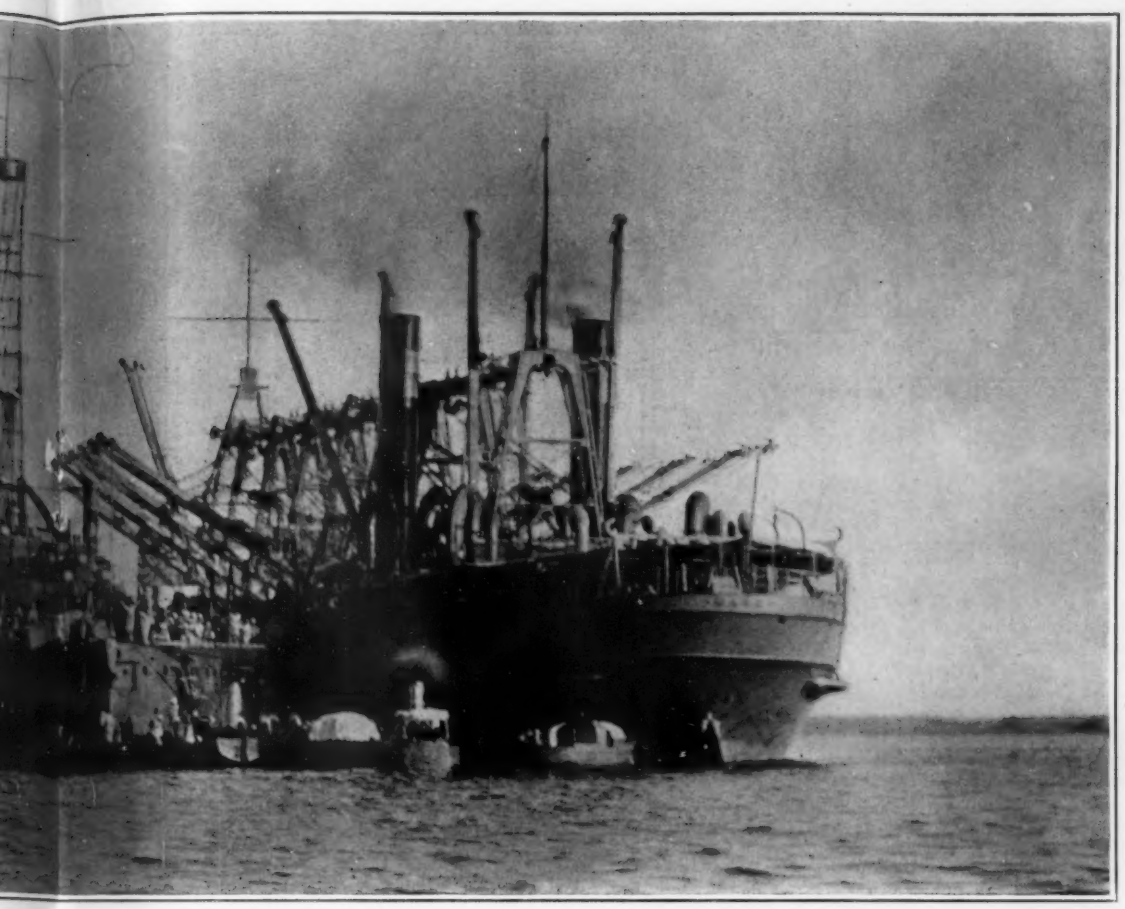
The navy colliers "Nereus" and "Jason," co



Photographs copyright by E. Muller, Jr.

Note the ship's band on the top of a turret, and the huge pile of coal dumped on deck, read

Scene on the deck of a battleship duri



record of sowing 500 tons in the bunkers in one hour.

d "Jass," coaling a United States battleship.

d on deck, ready for shoveling into the coaling trunks leading down to the bunkers.

attleship during coaling operations.

opened, the broken bones in them, some six thousand years old, were found to be in splints much the same as those of to-day.

Plaster casts, wood splints, and all of the surgical bone procedures of nowadays are to be seen in the remains excavated from ancient ruins.

But along came a few surgeons two or three years ago and startled the old, complacent, satisfied fogies, and said: "Surely there must be a quicker and better way to link up the ends of broken bones." So they sat down and schemed out a new method.

They realized that since Pasteur and Koch had found out the causes of blood poisoning, to wit, not dirt, dyes, sewer gas, and humors, but bacteria, all that is necessary to do now in order to take hold of the ends of the bones and bring them together, is to open an arm or a leg, just as the belly is opened for an appendicitis operation.

That is to say, by freeing the flesh and bones of all danger from lurking, flying, jumping germs, the surgeon may now do wonders with broken bones, instead of dallying and delaying with jackets, casts, and splints, or blaming the slow healing upon that scapegoat of ignorance called "*nature*."

When the young and dashing surgeons defied medical stand-pattism and officious inactivity by the proposal to actually cut into every broken bone and literally to stitch it together as you would a mattress or a split skirt, some of them were ejected from medical societies or otherwise pestered or interfered with.

Yet the curious part of it all is the fact that no physician thought of this sooner. There they were sawing open the skull, pasting up the brain, gluing together torn nerves, basting the macerated appendix, and doing odd jobs on all the internal structures of your melancholy anatomy, with never a thought of danger to you, yet they forgot the ribs, the shoulder blade, the funny bone, and the housemaid's cracked knee.

Comes now Prof. Charles Donson, the distinguished surgeon of the Illinois University Hospital, Chicago, with an ultra-modern and super-novel way in which to hurry the healing of the hurt humerus, leg bones, shin bones, or any other bone.

When a simple fracture of a long bone is fixed by splints as physicians do, and have done for milleniums, the internal bone-marrow begins to help to form a plug between the broken ends to hold them in place. In the physiologic way of healing the bone, this internal, natural splint, says Prof. Donson, is the main spring and stronghold of the newly formed bone.

If this method of living tissue were imitated by the surgeon, according to the excellent results obtained by the Chicago surgeon, broken bones would be as snug and tightly healed very quickly instead of incapacitating the victim for from six to twelve weeks.

Your earning power and efficiency would be vastly increased, and broken limbs would be quickly forgotten.

Prof. Donson has succeeded in effecting this very thing. If you break your arm, wrist, ankle, leg, or what not, and fall into the hands of a skilled surgeon such as Dr. Donson, he will do as he describes of a number of recently and rapidly recovered patients, namely, cut open the parts, go right down to the bone, and insert pegs of your own or frozen bone saved for just such emergencies, as a "couple" between the broken parts.

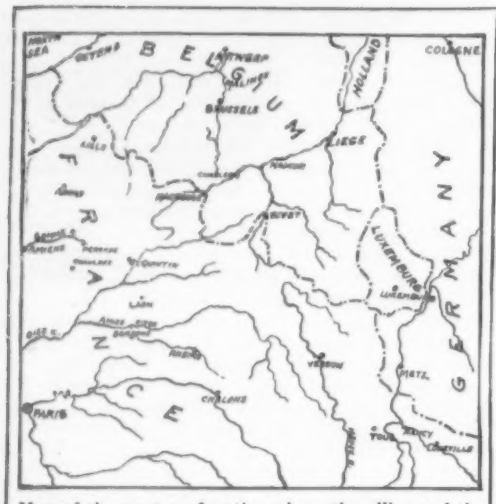
Six patients with fractures of one sort and another of the elbow, forearm, thigh, hip, and other sections of the skeleton had the broken bones thus "sewed together." Pegs or splinters of bone were taken or "sliced off" from bones nearby, and these were inserted into the middle or marrowy parts of the fractured segments.

Thus, almost instantly, without the tardy methods of nature, but by the artifice of Prof. Donson, those with broken legs who would have been laid up, as is now generally true, for two months or thereabout, were up and walking upon the broken leg in from three to four weeks.

This discovery is a vast advance even upon sewing up the broken ends. In the latter step, which is also a progressive one over the old way, the bone is held nicely in place by the stitches, but there is no support for new bone to hasten the restoration to normal.

In Dr. Donson's procedure, the basis is there in the form of a splint that can be used as food, soil, support, and first aid. Moreover, it becomes a part of and is fused with the new bone.

The Owner Checks Up the Automobile.—A patent, No. 1,109,191, has been issued to Frederick A. Wieland, of Chicago, for a construction for preventing the overspeeding of automobiles, which includes a casing containing tokens, a certain number of which are stored under lock in the casing and are automatically discharged when the machine exceeds a certain limit so that the owner can, by observing the number of tokens discharged from the case, keep a check on the manner in which his car is being operated.



Map of the western frontier where the allies and the Germans are now deadlocked.

The War in Europe

Letter from the Military Expert of the Scientific American, October 1, 1914

The eastern frontier where Russia is contending with the Austrians and the Germans.

The Campaign in France.

WHEN the British and French found that the Germans were strongly entrenched along the Aisne River and to line southeastward to Alsace, they had to choose whether to attempt to pierce the German center at enormous expense in lives, or to force them back by working around a flank to a position from which they could threaten their lines of communication.

Time is not a necessary element of success for the Allies; indeed, any delay in the decision of the campaign redounds to their advantage. Germany and Austria have reached the full development of their military strength, as have France, Servia, and Belgium. Russia will hardly get her armies at the front fully organized before November, while Great Britain is only about half started. Every day will then see the numerical advantage of the Allies increased.

An attack through the center has much more decisive results if successful than one around the flank. By separating the opponent into two parts his co-ordination of strength is destroyed. The parts of his army lose to some extent their power to support each other; the assailant in a central position can concentrate his army first in one direction then in the other, destroying his opponent in detail.

This is the position at which Napoleon aimed in all of his campaigns, and his success in attaining it was responsible for most of his victories. At Austerlitz in December, 1805, he allowed the combined Austrian and Russian armies to surround his right flank. Then checking this turning move with one corps, he launched the Guard corps and those of Soult and Bernadotte at the opponent's center, broke through, turned south and destroyed the Austrian and Russian forces that had been threatening his flank.

It was this strategy that dictated the French advance against the German Fifth Army under the Crown Prince in the Argonne Hills, northwest of Verdun. These hills had tended to separate the fourth and fifth armies during their retreat, the fourth army being supplied from Sedan and the fifth from Luxemburg. The Germans discovered the danger and rushed up reinforcements that re-established a strong connection between these two armies. The French and British then fell back on the turning move around the German west flank to obtain their object of forcing the Germans to evacuate France.

The first move was to push forward on the north side of the Oise River a newly organized army of reserve corps under Gen. d'Amade. The Germans discovered this move and rushed forward reserves, gathered in garrison detachments, and formed an army under Gen. von Boehm to extend their right flank. The French advance penetrated as far as St. Quentin, where its advance guard was driven back by the Germans. A further reinforcement of Gen. von Boehm's army by troops reported as withdrawn from the German center enabled him to force Gen. d'Amade's army back 15 miles, nearly to Bray on the Somme River.

Detachments of the Allies have appeared in force far to the north of this district on the line between Arras and Lille. These could not be so far advanced unless supported by larger bodies in the rear, possibly the new British army that is rumored to be landing at the Channel ports. Unless the Germans can check this threatening move they will have no choice but to retire to a less exposed position.

In order to relieve pressure on their western flank the German sixth army, composed of the Bavarian corps, under their Crown Prince, advanced against the strong line of forts south of Verdun and broke through to the Meuse River. This move was not sufficiently supported, and was taken in flank by a French army from Toul, forcing its retirement from its advanced position.

The success of the German heavy siege guns in reducing the French fortifications is one of the notable features of the war, but is only a repetition of their tactics in 1870. By taking into the field the largest howitzers used up to that time they forced the surrender of sixteen French fortresses by bombardment alone. Four were given up without defense, and five were captured after siege.

The explanation is that these present forts were constructed nearly a generation ago, prior to 1890, when the 21-centimeter mortar was the largest gun considered sufficiently mobile for use in the field. Masonry arches were made 2.5 meters thick, and the steel cupolas were given a thickness of 20 centimeters. Dictates of economy prevented the national legislatures from appropriating the funds needed to strengthen the defenses against the ordnance developed in recent years.

Roughly speaking a shell is effective against a thickness of chilled steel equal to its caliber and against ten times its caliber of concrete. The Germans profited by the Japanese success in using heavy seacoast 28-centimeter howitzers in their attacks on the Port Arthur forts to develop a lighter type of this gun that can be transported under favorable conditions. By the above rule it is effective against 28 centimeters of turret or 2.8 meters of concrete. Wherever it can bring its fire to bear this gun can batter to pieces the older type of fort.

The French defense has to rely on strengthening the fortifications by added earthen parapets, on the placing of heavy guns for counter firing, and on the operations of their field armies to hold off the German attacks.

The Russian Campaign.

The Russian plan of operations consists of a defensive campaign in the north, while they push the campaign against the Austrians. The German army of Gen. von Hindenburg has successfully pushed its advance from East Prussia until the Russians have been forced back to the Niemen River. It is important to the Russians to hold this line to protect their rail routes lying behind it, so they may be expected to rush forward reinforcements until the German invasion is held to this line.

In Poland the Russians are slowly concentrating armies to force back the German invasion of the western provinces. This is the line of advance that most threatens German territory. Both through East Prussia and through Silesia the Russians will be opposed by fortified lines that will greatly delay their advance. By making their projected invasion through Poland they turn both of these obstacles and arrive directly upon Central Germany.

In Galicia the overpowering Russian advance has forced the Austrians to abandon seven eighths of the province and to fall back toward Cracow. This move steadily shortens the front that they have to defend and brings them within supporting distance of the German army in southwest Poland.

The Austrian holding of the line from Tarnow to Sanok was largely a rear guard position to protect the above withdrawal. The position now occupied, north and south through Tarnow, makes them the right wing of the combined armies stretching from the Carpathians to the Black Sea. The Russian plan of operations against this strengthened resistance seems to be a continuation of the attacks upon the Austrians in the effort to break down their resistance before they can reform.

Geared Turbines and Electrical Propulsion

THE subject of the geared turbine was referred to in our last Engineering Notes, and we then mentioned that certain developments regarding this type of machinery were in progress in America. This has prompted a patriotic correspondent, Mr. William P. Durtnall, to point out that the system of propelling vessels by means of rotary steam engines or turbines combined with mechanical speed reduction gear for driving screw propellers for ship propulsion cannot be claimed by the Americans as a special "system" of their own, seeing that this system was the subject of a British patent granted to Mr. Joseph Bramah, an engineer, of Piccadilly, London, as far back as May 9th, 1785, which patent can be examined at the British Patent Office, off Chancery Lane, to-day.

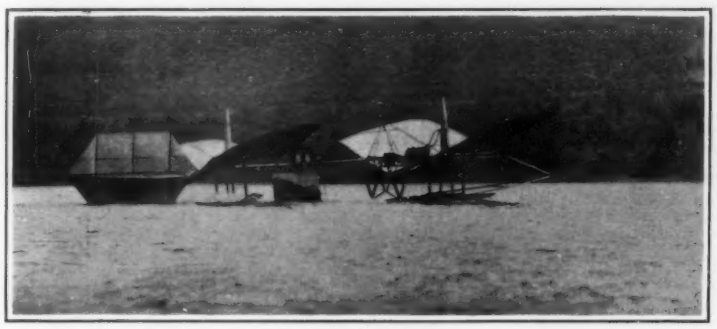
Mr. Durtnall, whose work on the electrical propulsion of ships is so well known, states that the system of geared turbines adopted in America on the collier "Neptune" is substantially the same as that which he himself proposed many years ago for the purpose of reducing the steam consumption of steam turbines, and it was only on reference to the above-mentioned patent of Mr. Bramah's that he did not lay claim to it, as it was obvious that anyone could use it, as the "patent" has now been public property for about one hundred and fifteen years.

A further interesting reason that caused our correspondent to seek fresh fields of investigation into marine propulsion systems, apart from that of the geared turbine, was that he held to be dangerous the heat generated in the gearing of big power units—dangerous because of the fact that the mineral lubricating oil which is used in the gear reduction cases may form into an inflammable gas. Men have even been killed through the explosion of gasified lubricating oil arising from the crank-chambers of large Diesel engines, and a similar peril may arise in connection with geared turbines; in any event, one observes large notices, "No smoking is allowed," in the engine rooms of most geared turbine ships.

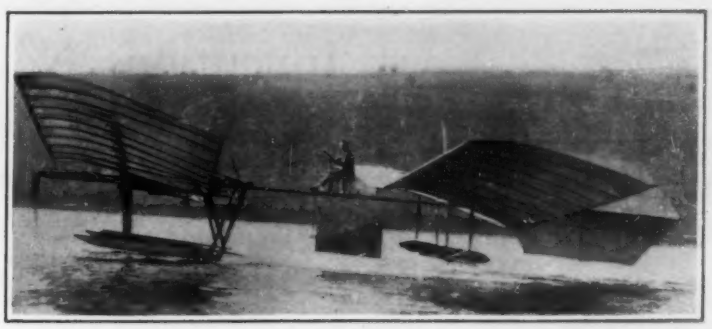
The whole question of new methods for the propulsion of ships is so vitally important in all its details that the American Government caused to be built, and has conducted experiments upon, three sister ships with a view to settling the question of the most satisfactory propulsion system. These three ships have just the same boiler capacity, the only difference in the design being the actual method by which their propellers are driven.

Of these vessels the "Cyclops" is the best type of reciprocating steam-engined ship of the same speed, displacement, and revolutions per minute afloat. The "Neptune," to which we have previously referred, has geared turbines, and the "Jupiter" is propelled on Mr. Durtnall's polyphase alternating current system, which was first described in 1908 at the Franco-British Exhibition Meeting of the Institute of Marine Engineers. The "Jupiter" has twin screws driven by electric motors developing 6,940 horse-power, a turbo-generator supplying the necessary electricity.

All these ships have now been through their official trials, the average speed during forty-eight hours being 14.6 knots in the case of the "Cyclops," 13.8 knots in the case of the "Neptune," while 15.1 knots was the figure of the electrically propelled "Jupiter," which thus easily surpassed the contract speed of 14 knots. The steam consumption of the last, of 11.2 pounds per shaft horse-power at 115 revolutions per minute, is claimed to be about 30 per cent lower than that of the very best type of steam-engined ship afloat.—*The Daily Telegraph.*



Overloaded in front.



Clearing the water.

Further Flights with Langley's Aeroplane

By Our Staff Correspondent at Hammondsport

THE rehabilitation and first trials, at the Curtiss aerodrome on Lake Keuka, N. Y., of the great Langley monoplane of 1903 were described in the SCIENTIFIC AMERICAN last June. The tests showed that this scientifically designed pioneer flying machine was capable of flight with precisely its original propulsive plant, wings, and rudders, and with 40 per cent additional aggregate weight, due to floats and extra framing to attach them. Then the trials were temporarily halted in favor of the elaborate and feverish experiments with the "America," the Rodman Wanamaker transatlantic flyer. The Langley was unwinged and stored nearly three months in the hangar at the lake side.

Toward the middle of August Mr. Curtiss went to California, leaving further tests of the big monoplane in charge of his mechanicians. He had instructed them to mount one of his 90-horse O. K. motors with a direct-connected tractor screw on the fore part of the aeroplane frame, and to set aside for the present the original motor and twin propellers. As these had several times driven the machine in short flights, he saw no advantage in making them continue to bear a 40 per cent extra burden, especially as the ball-bearings of the propeller shafting never had been over strong for their normal work. In case of wreckage he would feel far less keenly the loss of a regular stock motor than the loss of that splendid pioneer engine, so much admired for its workmanship, and which truly may be called the first gasoline motor in history, adequate to carry a man in sustained mechanical flight. Moreover, he had from the beginning intended to use a Curtiss motor, but had not at first hit upon a simple way of mounting it and keeping the propeller free of the front stay wires.

As the chief designers and constructors at the factory were now very busy, the adjustment of the new motor and propeller, to the aeroplane, was left to a practical mechanic who worked at the job leisurely during his spare time. None of Prof. Langley's nice computations and preliminary studies were attempted. The machine was "balanced up" as a farmer balances hay on a wagon, by looking at it from different sides and applying horse sense. Presently the craft was placed on the water and moored, with a rope and spring-balance, to a stake on the shore. The propeller gave a static thrust of 410 pounds. Maybe that would do; if not, the screw could be quickly removed and one, two or three others, taken from stock, could be tried in turn. While the propeller was spinning, it sucked up water from the lake and blew a cold spray over the bystanders. Frank Kleckler, the practical man in charge, put on his raincoat and finished the measurement. He now had the Langley ready for its wings and for its first run.

In the absence of Mr. Curtiss, his aviation instructor, "Doc." Wildman, piloted the aeroplane, with its new motor. Seated above the main frame, behind the front wings, he ran the craft cautiously over the lake, while some of the factory men and Dr. Zahm of the Smithsonian Institution accompanied it in a motorboat to observe its running balance. The pontoons were too far back, the weight too far forward, the rear wings set at too large an angle. The latter difficulty had been foreseen by Prof. Langley, who had provided notches for fixing the leading edges of the wings as high or low as seemed necessary. When the angle was lowered and the pilot and pontoons shifted along the frame, as a grocer slides weights along the beam of his scale, another run was made, resulting in several short flights. "Doc." Wildman was then called to California, and was succeeded by one of his pupils, Mr. Elwood Dougherty.

After some little "feeling out" of the machine, Mr. Dougherty notified the photographers of his intention to attempt a flight. Waiting till they were a thousand feet from shore in a motorboat, he started from the aeroplane to overtake them. The Langley, with its swollen wings gleaming bright yellow in the clear sun, and its floats skimming lightly with foaming heels, sped forward in graceful poise, cleared the water near the cameras, and soared half a thousand feet forward at an elevation of three or four yards. The flight was twice repeated, and the craft was then returned to

The machine climbing.

shore for a longer voyage, as soon as a larger propeller could be added. A light breeze, not quite strong enough to raise white caps, was blowing during the trial.

Two days later some better results were achieved. The pilot had said the craft was in easy control, but mounted too readily and lacked thrust. Accordingly the front wings were lowered from an angle of 12 degrees to one of 10 degres, and the 8.5-foot screw was exchanged for a 9-foot screw. The rear wings were left at about 10 degrees angle of incidence. When the photographers were again in place, the shining craft tripped lightly over the sunlit waves, and slid gracefully into the air in excellent poise and at a speed neighboring 35 miles an hour. Hovering within ten yards of the water, it ascended on a very easy grade, soared along 3,000 feet, declined to the wave tips and soared again 2,500 feet. Both on the water and in the air its movement was stable and majestic.

In all the foregoing experiments the aeroplane when fairly adjusted maintained a secure and steady poise, both in planing and in flying. By virtue of the dihedral angle between its wings it possessed good inherent lateral stability. No wing-warping or aileron attachment had been provided by Prof. Langley, and none was used either at present or last spring. True, Langley had placed well below the main frame a wind-vane (vertical) rudder, which could be made to exert a righting as well as a steering effect, but neither Curtiss nor his men ever employed this rudder since the first brief flight in June. It was, in fact, tied fast and remained inactive. In its stead the big tail was used to steer right and left. The big tail was used also as an elevator, as in Langley's day. The reason for steering with the tail instead of the wind vane rudder, as in Langley's scheme, was to secure a more powerful hold on the wind while the craft was running on the water. Once aloft, the little rudder could, if put to use, very well steer the machine, as Langley intended.

At the conclusion of the last trial, toward the closing hour on Saturday, September 19th, the Curtiss workmen volunteered their services for the morrow. They wished to see the aeroplane, after a slight shifting of the pilot's seat, fly several miles and cut figures in the air, before the rough autumnal winds should begin. But their superintendent, Mr. Kleckler, thought it best for them to rest on Sunday, and chance the weather following. Unfortunately the stormy weather came before the long flight could be attempted, and the scientific observations that were to attend it.

Dressing off the board marks from a concrete wall.

Power-driven Hand Tool for Surfacing Concrete

IN the construction of concrete walls and ceilings, board marks are left on the surface, and have to be removed. Ordinarily this is done by hand. A carborundum stone is rubbed over the surface and water is used to clear away the grit. This results in forming a paste or mud which, by the action of rubbing, is ground into the wall, leaving an unstable material in the pores, and giving the surface a streaky appearance.

Recently a power-driven hand tool has been invented for removing the board marks. This works dry, and it leaves the surface slightly porous, so that it provides an excellent base for the application of a float or a coat of paint. The machine is driven through a flexible shaft by a motor carried by the opeator. The whole apparatus, motor included, weighs only 20 pounds. The motor may take its actuating current from an ordinary electric light socket.

The surfacing tool is very ingenious. Instead of depending upon a grinding action, the principle of chipping the concrete surface is employed. Mounted in a disk are twenty-four cutter wheels arranged in pairs, each wheel having from twenty-four to twenty-eight cutting teeth. As the disk revolves at high speed, the cutter wheels are made to roll over the concrete surface, each tooth acting as a tiny hammer to strike the concrete. The cutter wheels look like small spur gears, but instead of being radial, the teeth are eccentrically directed so that their edges are brought into contact absolutely square with the surface, and deal a direct blow to the material that is to be cut. The disk revolves at the rate of about 2,000 revolutions a minute, so that the number of blows per minute delivered by the cutter wheels runs up into the millions. The cutting tool is of such a form that it may be conveniently grasped and guided by the operator, and on it is a small switch by means of which the power may be readily turned on and off.

The average work per day of this tool is from seven to nine hundred square feet. The machine is ball-bearing throughout, and lubrication is so arranged that one grease cup at the junction of the motor and the flexible shaft supplies the entire tool with lubricant. There is an adjustment for the amount of cut which is provided by two front studs and two rear roller wheels. These may be adjusted independently so as to surface narrow projecting parts absolutely square without affecting the parallelism of the two rollers.

The machine may be used, as well, for surfacing stone and imitation stone, and for bringing out the aggregate in concrete, when that is desired.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

A Record Breaking Boring Mill

THE machinery of war calls for the construction of enormous pieces with extreme accuracy. In order to machine the turret tracks of the big 14- and 16-inch guns of our navy a huge boring mill, the largest in America, has just been completed and delivered to the Brooklyn Navy Yard. It has a swing 36 feet in diameter with 12 feet under the tools. There is a type of boring mill, known as an extension mill in which the uprights may be moved back on an extension of the bed in order to admit larger pieces on the table. However, this is not an extension mill, but a regular cross-rail machine with fixed uprights and an actual swing of 36 feet 2 inches.

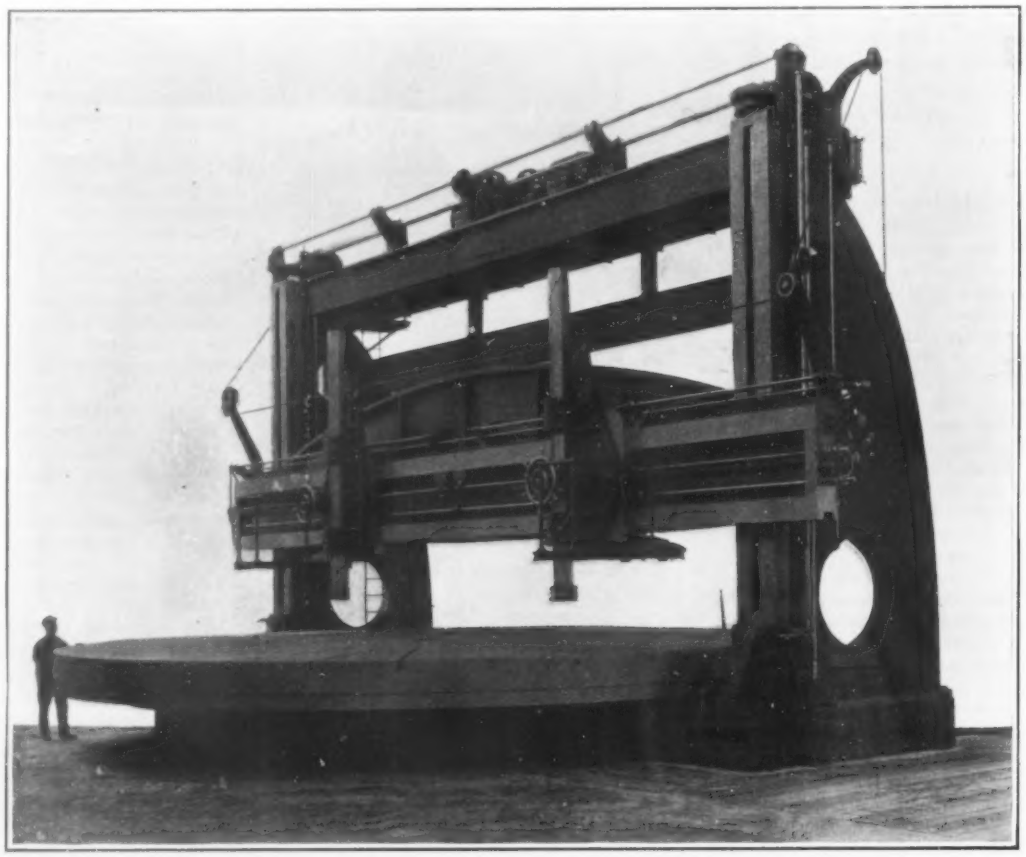
The table is 34 feet in diameter and will carry a weight of 200,000 pounds. The machine itself, including the motors which drive it, has a weight of 655,000 pounds or over 330 tons. The table is so big that it had to be cast in three parts, which altogether weigh 225,000 pounds. It runs on conical rollers which travel in a 24-foot track sunk in the bed. The table also rests on an adjustable bearing ring surrounding the central spindle. The latter is centered in the bed by an adjustable conical bush. The table is provided with a spur gear 28 feet in diameter, which is driven by two steel pinions placed on opposite sides.

The uprights, as shown in one of our photographs, are huge box castings weighing 32,000 pounds each and rendered rigid by the steel girders connecting them. The cross-rail would stretch across two city lots. It is 46 feet long and weighs 85,000 pounds. Owing to its extreme length a camber beam is bolted to the top of it so as to stiffen it and take up the sag due to its great weight and that of the heads. To raise this enormous cross rail a 30 horse-power motor is provided. This is located on the top cross brace and operates four elevating screws working in bronze nuts.

The two boring and turning heads are provided with graduated swivels with worm gearing, to permit of setting them to any desired angle up to 30 degrees from the vertical. The traverse of the heads may be effected by hand or, when a rapid movement is desired, by a 10 horsepower motor mounted on the top brace. A platform is attached to each head, upon which the operator stands to control the traverse of the heads and their feed. The operating levers are interlocked so that the rapid traverse cannot be engaged for one head unless it is disengaged from the other, making it impossible for the operator on one head to move the opposite one accidentally.

The table is operated by a main driving motor of 75 horse-power, and variable speeds are provided for boring, turning and facing operations.

This machine will be used not only for finishing the tracks of the turrets, but also for boring cylinders and machining the casings of the large steam turbines of our war vessels.



Giant boring mill, with a swing of over thirty-six feet, for machining the turret tracks of our big battleships.

The uprights are huge box castings weighing 32,000 pounds each.

A 70,000-pound section of the table.

The table was cast in three sections, the center one weighing 83,000 pounds.

Lectures in the Patent Office

OLD practitioners before the Patent Office recall the conferences which Commissioner Fisher held at frequent intervals with his office force, and in which he lectured the force not only on the administrative duties of the office, but on the fundamental law as related to the granting of patents by the Patent Office. Many important matters of practice were inaugurated during his administration of the office that have been continued to the present time. Commissioner Ewing has instituted the giving of lectures or addresses at intervals by members of his office force as well as some distinguished patent lawyers, doubtless in an effort to improve conditions and to standardize in a way the actions of the several divisions. Beginning with an address by the Commissioner himself on the administrative features of the Patent Office the lectures so far have included one by Mr. Willis M. Magruder, chief of the Assignment Division, on Assignments; one by Mr. Sewall, the chief of the Classification Division, on the Workings of His Department; an address by Examiner Loeffler, on Public Use; and one by Mr. Charles H. Pierce, one of Mr. Loeffler's assistant examiners, on Abandonment; and one by Frederick P. Fish, the distinguished Boston patent lawyer.

Mr. Fish directed his remarks mainly to a discussion of the question of patentability lamenting the absence of a uniform standard of patentability resulting from the different points of view and various mental attitudes of those passing upon the subject, not only in the Patent Office, but in the courts as well, and expressing the belief that a Court of Patent Appeals would do much to secure such uniformity of standard. In the course of his address Mr. Fish took occasion to pay a high tribute not only to the ability, but to the honesty, industry, and sincerity as well of the Patent Office force, and urged upon them the importance and propriety of their entertaining a friendly attitude toward the applicants even to the extent of suggesting patentable features in official actions, rather than permitting themselves to take any hostile stand.

Such advice is to be commended, as, if properly followed, the results would be most helpful in encouraging inventive progress, which is really the province of our patent system.

RECENTLY PATENTED INVENTIONS

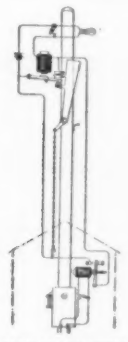
These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

ADJUSTABLE NECKWEAR.—G. W. COOPER, care of W. H. Browning, 16 Cooper Square, New York, N. Y. This invention primarily consists in the provision of a collar or neckband having an arrangement of buttonholes to permit the apparel to be properly adjusted to the neck of the wearer before and after the same has been laundered, thus providing against tightening of the neckband or collar, due to shrinking, and also against enlarging thereof, due to stretching.

Electrical Devices.

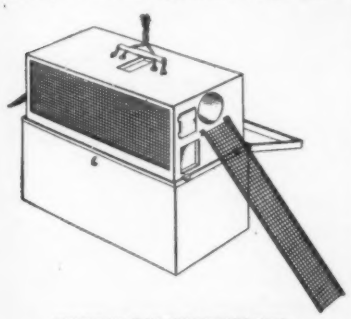
SIGNAL SYSTEM.—F. H. WEBSTER, Marvell, Ark. This invention relates generally to a visual signal, and is more particularly directed to an electrically-actuated mechanism adapted for co-operation with a telephone circuit. It provides a visual signal, in connection



SIGNAL SYSTEM.

with a telephone circuit, whereby the central office may throw into exposed position a semaphore arm, or may light a lamp located at any suitable point, the signal-actuating mechanism being controlled by the calling current through the telephone.

ELECTRIC RAT EXTERMINATOR.—J. W. M. CARMICHAEL, 331 Commerce St., Wellsburg, W. Va. This exterminator is of that type in which a rat is enticed into the device and in attempting to reach the bait is included in an electric circuit, so that current passing through the body of the rat electrocutes it, the present



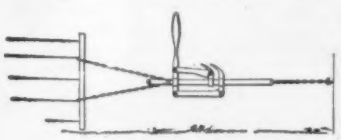
ELECTRIC RAT EXTERMINATOR.

invention being more particularly in the type of exterminators shown in the U. S. Letters Patent No. 1,034,976, formerly granted to Mr. Carmichael. The current used stuns the rats so that they will drop into a body of water and be drowned therein. A tray in the bottom of the tank is removable in water, to take out the entrapped and drowned rats.

FLASH LIGHT.—W. E. COMPO, Toledo, Ohio. This inventor provides a light which may be used with the standard sized dry cells. He also provides a light which may be quickly and easily attached to or removed from a dry cell, and which may be adjusted when in place thereon in positions where flash or steady light may be obtained.

Of General Interest.

STRETCHING DEVICE.—E. O. FOULK, Pioneer, West Carroll Parish, La. This stretching means is more particularly adapted for embodiment in a belt stretcher, and also is useful for embodiment in a wire stretcher. The device when embodied in a belt stretcher may be



STRETCHING DEVICE.

quickly and conveniently applied to a belt by one man, and may be rapidly and conveniently operated to effect the desired stretching of the belt with a minimum loss of time. The invention also provides a stretching means possessing features that may be advantageously embodied in a simple form of wire stretcher.

RELEASE SAFETY HOOK.—W. BROWN, A. C. E. BROWN, and T. B. MERRY, Adelaide, South Australia, Australia. This invention has been devised for use with boat davits, for securely holding and quickly releasing ships' boats, but it may be used in connection with general lifting and other purposes where hooks are required. It comprises two side members, a shackle, a spring, and a locking ring.

FASTENING.—D. W. KOLLE, corner of 6th and Washington Sts., Portland, Ore. This invention provides a fastening more especially designed for fastening the posts or studs to lenses of eyeglasses and spectacles, and arranged to securely hold the lens in position on the post by the use of a screw holder out of contact with the lens.

SUCKER ROD PULLING DEVICE.—J. B. DUNLAP and W. D. BRYAN, Tulsa, Okla. This device is of use in lifting tubing, and the invention provides one having means for utilizing the ordinary pumping jack for lifting the sucker rods and tubing from oil wells and the like, thus dispensing with the necessity for a sucker rod pulling machine.

SEPARABLE EARTHEN INSULATING PIPE CIRCUIT.—W. B. GRAY, Louisville, Ky. The object here is to provide a conduit having oppositely arranged pairs of longitudinal scores or cuts at each side, arranged to permit the upper half of the conduit to be easily and expeditiously separated from the lower half, to permit the insertion of the pipe.

PIPE SUPPORT.—W. B. GRAY, Louisville, Ky. This invention provides a support adapted for supporting heating, steam pipes, and the like in earthen conduits, or other conduits, wherein a cradle is provided for engaging the conduit and a cradle for engaging the pipe, together with mechanism for connecting the saddle and the cradle to permit relative longitudinal movement of the saddle and cradle, and wherein other mechanism is provided for preventing relative vertical movement of the cradle and the saddle. Mr. Gray has also invented a pipe support for interposition between pipes, such as heating pipes, and the insulating conduit within which the pipe is laid, for supporting the pipe so that it may move during expansion and contraction without danger of buckling or bending of the pipe or injury to the conduit, and wherein the arrangement is such that the parts always occupy a definite position with respect to each other, whatever the movement.

SEPARABLE INSULATING EARTHEN CONDUIT.—W. B. GRAY, Louisville, Ky. This invention provides a conduit which may be, after baking, separated into upper and lower sections, to permit the lower section to be laid in the excavation and to receive the pipes to be supported, and afterward to permit the upper section to be placed and permanently connected to the lower section, and wherein the conduit is so constructed that a plurality of independent pipes may be supported in the conduit alongside one another, the supporting mechanisms for the several pipes being also independent.

DRIP RECEPTACLE FOR UMBRELLAS.—C. J. MADONNA, 443 Seventh Ave., Brooklyn, N. Y. In order to accomplish the objects of this invention, use is made of a cup having an attaching hub adapted to engage the terminal of the umbrella stick to hold the drip receptacle in place, a collar for the passage of the said terminal and a tubular covering attached at its ends to the said cups and the said collar.

Hardware and Tools.

SCISSORS.—J. L. BITZ, 27 Perkins St., Coldwater, Mich. In the present invention the improvement has reference to scissors, and has for its object the provision of a pair of lever blades with inexpensive removable cutting members which may be conveniently replaced when those that have been in use become dull.

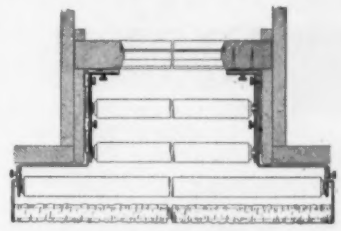
WEED DESTROYER.—C. O. BLANDIN, W. T. DAVIS, and W. A. REYNOLDS, 506 E. & C. Building, Denver, Colo. This destroyer is of the kind in which a liquid poison or other destructive liquid or material is applied to the roots of the weeds. The invention provides a device whereby a measured charge of the liquid is applied locally to the roots of the weeds, in order to destroy the weeds without danger to neighboring grass or other vegetation.

WRENCH.—L. W. MILLSAP, Jr., Woodland, Cal. This invention provides a wrench having an adjusting screw, whereby the wrench may be loosely adjusted upon a nut, and having a locking lever whereby after loose adjustment of the wrench the jaws thereof may be tightly forced against the nut, to prevent slipping of the wrench.

Household Utilities.

GREEN CORN SPOON.—A. TAUBERT, 631 E. 168th St., Bronx, N. Y., N. Y. This structure will readily remove the grains of corn without mashing the same. Another object of the invention is to provide an instrument in the nature of a spoon, which may be used for cutting the grains from an ear and either leaving the corn in place on the cob after being severed therefrom or placing the rows of grain on a receptacle.

WINDOW SHADE SUPPORT.—J. A. BERCHTOLD, Sigel, Ill. The purpose in this instance is to provide a structure which will present to view from the exterior and also from the interior the usual appearance of the ordinary shade and support, but will allow an adjustment whereby air may be allowed to pass into the room over the shade. A further object is to provide supporting brackets for a plurality of curtain rollers, and for a curtain or portière, which brackets are adapted to be secured

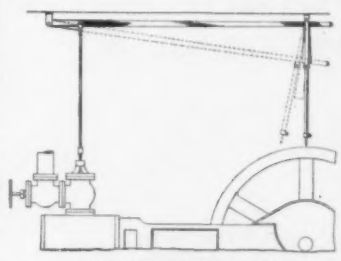


WINDOW SHADE SUPPORT.

to the window sash and be moved thereby, thus allow a free open space above the shades and curtain when the sash is lowered.

Machines and Mechanical Devices.

AUTOMATIC ENGINE STOP.—T. TRURAN, Glacier, B. C., Canada. In the present patent the invention has reference to automatic engine stops, and the object is to provide a simple and effective arrangement by which to shut off an engine supply valve in connection with



AUTOMATIC ENGINE STOP.

rope drives, and for actuation where the rope is broken and also where a splice pulls out or the rope slacks to such an extent that it might jump its proper groove and cause serious trouble.

CIGAR TUCK CUTTER.—G. W. BOWMAN, York, Pa. This invention relates to cigar cutters or trimmers of the type disclosed in Mr. Bowman's Patent No. 1,087,715. The general object of the present invention is the provision of a cutter of the type specified, with an automatic ejector for removing the cigars from a machine at the completion of the cutting operation.

MACHINE FOR REMOVING PULP FROM COCOA AND OTHER PULPY BERRIES.—J. M. URGELLÉS, care of J. Codina Morales, P. O. Box 897, Havana, Cuba. Use is made of a series of drums one above the other and having their inlet and exit ends arranged alternately on opposite sides of the machine, a feed hopper at the inlet end of the uppermost drum, chutes connecting the exit end of one drum with the inlet end of the next drum below, revoluble feeding members arranged in the said drums alternately with the feeding members. Means provide for separating the pulp from the berries.

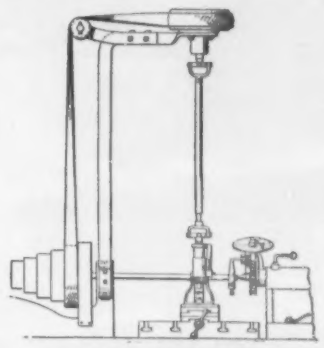
FIRE ESCAPE.—J. F. VICKERS, Colusa, Cal. In this escape the cable is supported on a reel adjacent to a window or other opening in position to be unreeled, wherein means is provided for holding the cable in position to permit persons to affix themselves to one run of the cable, and wherein other means is provided for persons desiring to escape to connect themselves to the said run, and wherein mechanism is provided in connection with the holding means for permitting the speed of movement of the cable to be controlled.

ADDING MACHINE.—J. D. WARD, deceased. Address Lillian H. Ward, 467 Normal Ave., Buffalo, N. Y. This invention provides a chain structure which is designed to be moved a certain distance when adding a particular number, whereby the operator can observe at all times the operation of the various parts and

ADDING MACHINE.

may know whether or not the movement of the chain is correct. It also provides an adding machine with chains formed with numbered tabs and co-acting means for raising the same so as to extend substantially normal to the chain in order to be grasped and operated by the operator.

GEAR CUTTING MECHANISM.—A. FRYKMAN, Souris, N. D. This invention relates to gear cutting machines, and more particularly to devices of this type which are used as lathe attachments for cutting gears and for seating keys. The invention is a lathe attachment comprising mechanism for holding a gear wheel



GEAR-CUTTING MACHINE.

to be cut and for shifting the position of this gear wheel so as to properly space the teeth relatively to the position of the cutter; and also mechanism driven preferably from the lathe pulleys and including shafting provided with telescopic slides and universal joints for readily transmitting power to the gear cutter.

Railways and Their Accessories.

RAIL FITTING.—H. J. BONHAM, Los Angeles, Cal. This improvement has for its purpose the provision of a simple, cheap means for smoothly and firmly connecting rails and pipes, which may be easily applied and removed, and which will firmly hold the rails and pipes in their proper relative position.

MONORAIL SYSTEM.—C. W. PUTNAM, Route 6, Mt. Carmel, Ill. This invention provides a rail support and balancing means for properly holding the car in position. It also provides a balancing arm structure connected to the car and associated with suitable braces along the track, whereby the swaying of the car is controlled and the strain properly distributed.

Pertaining to Recreation.

FIGURE TOY.—J. W. MURRAY, St. George, New Brunswick, Canada. This invention relates to toys and has particular reference to devices in which certain figures, such as, for instance, figures of ferocious animals are employed. Among the special objects of this in-

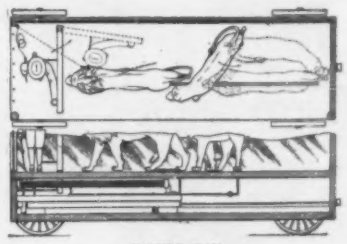


FIGURE TOY.

vention is to attract attention and create amusement by the simulation of a cage of wild beasts having a keeper, certain mechanism being employed whereby the animals and the keeper will be given certain movements.

Pertaining to Vehicles.

STEERING DEVICE FOR AUTOMOBILES.—J. R. JUNKIN, Fairview Hotel, Fairbanks, Alaska. This invention relates to steering devices of motor vehicles, and more particularly to those in which the actual turning of the wheels is accomplished through power derived from the motor, under control of the usual steering shaft or post, the invention being particularly adapted for use in connection with heavy machines, either pleasure or commercial vehicles.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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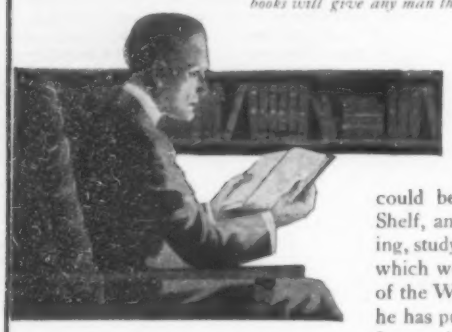

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SERT E. HOWE, Whittier, Calif.—*The books are worth many times their price to me. I am now averaging six more miles to the gallon of gasoline because of the simple instructions on Carburetor adjustment.*

L. J. WEISENHORN, Sec. Kurz Machine Co., Quincy, Ill.—*I received your set of "Power of the Hour" booklets and find them positively the best "trouble shooters" I have ever come across. In fact I have had them bound into one permanent book.*

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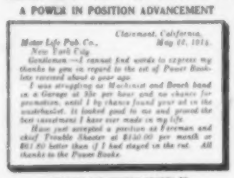

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Laying the Aqueduct Siphon Across the Narrows to Staten Island

(Concluded from page 300.)

the spigot of the next section. One of our photographs shows the first three sections of the pipe being laid. These had to be dragged down the skidway and hauled through a bulkhead to connect with the land end of the pipe line.

At the present writing, the pipe laying has not proceeded far enough to permit the lighter to be moved over the skidway in the position shown in our front page illustration. Instead of that, the cradle is secured to the side of the lighter, as shown in the photograph. As the pipe line runs down an incline from the shore until it reaches the requisite depth, the panels at the after end of the skidway are uncoupled so that they may conform to the grade of the trench.

Before the plan was completed for laying the siphon, extensive experiments were made to determine a safe depth at which the pipe line could be buried to bring it out of reach of heavy ships' anchors. To this end, anchors of various forms were dragged along the bottom of the harbor and their penetration was noted. As a result of these experiments it was decided to provide a cover of at least 8 feet over the siphon, and as the War Department requires a clear depth of 45 feet, this made it necessary to keep the upper wall of the pipe line at least 53 feet below the mean sea level. This calls for a great deal of excavation in some places. The dredge may not operate more than a thousand feet ahead of the pipe-laying lighter, lest the excavation fill with silt, under action of the tide.

There are about eight hundred pipe sections to be laid. At present about four sections are laid per day. The work may take the greater part of a year. During the winter operations may be suspended, owing to the difficulty of working in such an exposed location. The end of the pipe line will then be closed and dropped to the bottom. In the spring, when milder weather prevails, the end of the siphon will be picked up and hauled upon the launching cradle and the pipe laying will be resumed.

A Final (?) Word on the Benzoate of Sodium Controversy

THREE years ago, when Dr. Wiley's partisans were still inveighing against the findings of the Referee Board regarding the alleged poisonous action of sodium benzoate when used as a preservative of jams and meats, they claimed to derive much comfort from the results of a German investigation of the subject. The German government, having become interested in the American dispute, had requested a board of experts to give an opinion on the use of benzoic acid and its salts in the preservation of food. This commission criticised the findings of the Referee Board on the ground that its experiments with large doses of benzoates were of too short duration, and conjectured that ill results might follow the long-continued administration of the preservative in very large doses. It also advised against the use of benzoates in food on the theoretical ground that, though they were evidently innocuous in small doses, one might eat and drink in the course of the day so many things containing them that a sufficient quantity might be taken to be injurious. The commission stated, however, that one half gram (7½ grains) of benzoic acid or its salts consumed in divided doses throughout the day, must be regarded as harmless to the human body. This was sufficiently corrobative of the findings of the American Referee Board to convince any unprejudiced observer that the United States Government was justified, on the strength of this board's report, in permitting the use of benzoates as a preservative, provided the fact of such use was stated on the package. Some more recent experiments made by Drs. Rost, Franz, and Weitzel of the German Imperial Board of Health (Arbeiten aus dem Keiserlichen Gesundheitsamte, xlv, 425) have confirmed the previous findings as to the innocuousness

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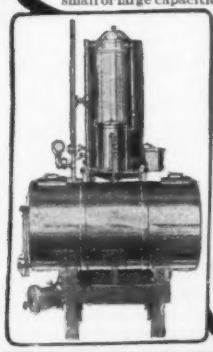

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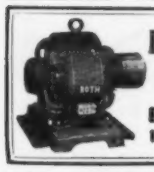

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of small doses continued throughout a long period and have shown that the fears expressed by the previous experimenters were groundless. They found that dogs could take daily doses of one gram per kilogram of weight of the animals for weeks and months without showing any toxic effects. This is the equivalent of over an ounce and a half per day for a man of 110 pounds, or 50 kilos, weight—a dose which could not possibly be taken in any amount of jam or other preserves that could be eaten in twenty-four hours. Rabbits could take even larger doses, from 1.5 to 2.4 grams per kilo of animal weight, the equivalent of about two to four ounces for a small man. This ought to dispose of the question finally, but probably will not, for those who were misled by the spectacular but not altogether scientific experiments of Dr. Wiley with his "poison squad" will never acknowledge themselves convicted of error by the German Imperial Board of Health after they have rejected the testimony of such men as Remsen, Chittenden, Herter, and Long, who composed the American Referee Board.—*Medical Record.*

Foreign Students at American Colleges and Universities

THERE were 4,222 foreign students in attendance at colleges and universities in the United States in the year 1913, according to figures just compiled at the United States Bureau of Education, and reviewed in *Science.* This is an increase of 577 in two years. These students are not concentrated at the larger and better known institutions, as might be expected, but are distributed over 275 different colleges, universities and schools of technology. The number given includes only regular students of college or graduate grade; if students enrolled in preparatory departments, short-term courses, summer schools and independent professional schools were included, the total would be very much larger.

Canada has the largest representation—653 students. China and Japan are not far behind—there were 594 Chinese students and 336 from Japan attending colleges in the United States in 1913. Of the other Oriental or Asiatic peoples, India is represented by 162 students; Turkey by 143; Korea by 13; Persia by 21, and Siam by 13.

Latin-America is strongly represented. Cuba sends 209; Costa Rica, 29; Guatemala, 15; Honduras, 12; Nicaragua, 18; Panama, 28, and Salvador, 19. Mexico heads the list with 223 students. From South America, Argentine sends 43 students; Brazil, 113; Bolivia, 3; Chile, 12; Colombia, 37; Ecuador, 16; Paraguay, 2; Peru, 25; Uruguay, 2, and Venezuela, 7.

Abundance of higher educational opportunities in the British Isles and on the continent of Europe has not prevented nearly 800 European students from coming to America to go to college. Great Britain and Ireland are represented by 212 students, and Germany, herself the Mecca of the studious, sends 122. The others, in order of numbers, are: Russia, 124; France, 45; Sweden, 41; Italy, 38; Austria-Hungary, 34; Switzerland, 29; Norway, 26; Greece, 22; Spain, 20; Netherlands, 19; Bulgaria, 15; Roumania, 6; Belgium, 4; Portugal, 3; Montenegro, 1.

Even Australia and Africa have students at colleges in the United States. There are 56 students from New Zealand. Africa is represented by 15 from Egypt; 2 from Liberia, and 44 from South Africa.

From American possessions 434 students came to college in the United States; 108 from Hawaii; 215 from Porto Rico, and 111 from the Philippine Islands.

Clipped Rugs by a New Process.—Consul Homer M. Byington, of Leeds, writes that clipped rugs which for many years, heretofore, have been made by hand in Yorkshire, are now proposed to be made by a new process, whereby they can be turned out by machinery at the rate of sixty to seventy per hour, and a syndicate is reported to contemplate starting a rug making industry in some town nearer to the center of the West Riding of Yorkshire.

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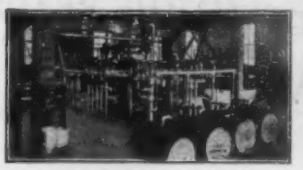

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NEW BOOKS, ETC.

DIE TECHNIK DER VORZEIT, DER GESCHICHTLICHEN ZEIT UND DER NATURVOELKER. Ein Handbuch fuer Archaeologen und Historiker, Museen und Sammler, Kunsthaendler, und Antiquare. Von Franz Feldhaus. Mit 873 Abbildungen. Leipzig und Berlin: Verlag von Wilhelm Engelmann, 1914.

This volume may be regarded as a very useful reference book on the history of technology, in dictionary form. The author does not present it as an exhaustive inquiry into every branch of technics, but rather as a means of assisting those who take an academic interest in certain phases of technology. Mr. Feldhaus has for years patiently gathered an immense amount of material on the history of science and engineering. He has frequently contributed to technical and popular periodicals very valuable and instructive articles on the evolution of machines and processes. He is probably the best-informed man in Germany on the historical aspects of science and engineering, and therefore peculiarly competent to undertake the preparation of such an ambitious work as this. Although compiled in dictionary form, Mr. Feldhaus's book is really an admirable history of technology, and not simply a history of some well-known arts. The dates have all been so carefully checked up that museums, in particular, will find Mr. Feldhaus's book very useful. It has been rather difficult in the past to make any positive assertions as to the introduction of an invention or process, because very few technically informed men have taken the trouble to interest themselves historically in their own profession. Particularly interesting and valuable are the illustrations, which have been lavishly incorporated. They are, all of them, of immense historical value, and all of them selected for their technical fitness. Indeed, the illustrations alone represent in their gathering an immense amount of labor, for which the antiquarian ought to be truly grateful. Mr. Feldhaus has prepared in brief an extremely valuable reference book, which contains an enormous amount of information not to be found in the regular cyclopedias and which should be extremely useful to the special student.

SLIDE-RULE NOTES. By Col. H. C. Dunlop and C. S. Jackson, M.A. New York: Longmans, Green & Co., 1913. Crown 8vo.; 127 pp.; with diagrams. Price, 75 cents net.

Students and users of that ingenious little device, the slide rule, will find in this monograph, based upon a work of the same title now out of print, full and clear information of the various uses to which the instrument lends itself. The material of the earlier work has been revised, rewritten, and added to, and there is an entirely new section dealing with the logologarithmic scales. Mannheim's 25-centimeter rule is the type almost exclusively dealt with. Hence the work serves as an introduction to the more elaborate types.

THE OFFICIAL GOOD ROADS YEAR BOOK OF THE UNITED STATES. Washington, D. C.: American Highway Association. 8vo.; 501 pp.

A brief history of road building, the systems of foreign countries, and legislative development are presented in the early pages of the volume. Types of roads, dust prevention, and maintenance and repair receive considerable attention, while a large portion of the work is given over to lists of highway officials, patents pertaining to roads, bulletins and circulars on the subject, and the existing associations of the various states.

BUSINESS ADMINISTRATION. Its Models in War, Statecraft and Science. By Edw. D. Jones. New York: The Engineering Magazine Company, 1914. 16mo.; 275 pp.

This is a volume in the "Works Management Library," and gives a history of the development of a new profession. The author deals with the administrator as general, the administrator as scientist and the administrator as diplomat. The book is an extremely interesting one to any modern business man who is at all interested in efficiency. The arguments of the author are as follows: First, that success in dealing with men and affairs depends upon certain basic propositions and laws which can be discovered by studying the work of successful administrators. Second, that the rules and methods followed by masters of business and finance are usually deliberately hidden, and there are no records throwing clear, full light on their lives and acts. Third, that leaders in statecraft, war and science, on the contrary, are figures of world interest whose careers and practice are illuminated fully and searchingly by public and private records, correspondence, personal reminiscences, and even petty gossip. From such data Prof. Jones has analyzed definite primary principles of administration. In history and the biographies of military conquerors, diplomats and scientists he finds the elementary rules of success.

THE MANUAL OF STATISTICS. Stock Exchange Hand-Book, 1914. Thirty-sixth Annual Edition. New York: The Manual of Statistics Company, 1914. 12mo.; 1,110 pp. Price, $5.

"The Manual of Statistics" brings together the best aggregation of facts, which makes it of great value. It is a work of reference, not only for the broker and banker, but for the businessman as well. It takes up the question of railroad securities, industrial securities, mining, etc. It is the recognized standard in the financial world, and at least one copy should find a place in every office.

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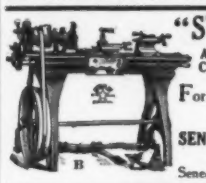

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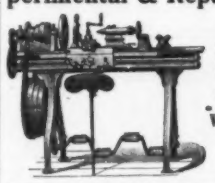

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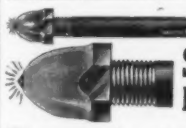

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Some of the "Whys" of the Eight-Cylinder Cadillac

The superior steadiness of the Eight-Cylinder Cadillac has its source in several causes, each and every one of them scientifically exact.

This superlative smoothness, in other words, is not left to chance, but is the positive result of positive principles.

And these positive principles exert secondary influences, each of which, in turn, contributes to the same desired end.

Translated into the simplest language, eight cylinders mean greater continuity in the generation of power. The greater the degree of continuity, the greater the smoothness, and the less the vibration, of course.

This, then, is the main and primary source of that steadiness which makes you forget that an engine is at work carrying the car forward.

The power impulses are not "almost" continuous, but actually and completely continuous, so that you are assured that the riding qualities of the car are as scientifically smooth as they can practically be made.

And then there are added to the main principle, the supplementary advantages which accrue from the very nature of the V-type engine—every one of them tending, again, to lessen vibration.

The crankshaft in the Cadillac V-type eight-cylinder engine, for instance, is but $26\frac{1}{16}$ inches long, between the outer ends of its rear and forward bearings.

Experienced motorists, familiar with the periodic vibration or "thrashing" which is characteristic in engines requiring a long crankshaft, will recognize immediately the beneficial effect of the lesser length.

The cam shaft, which is driven by a silent chain from the crankshaft is likewise shorter, and another tendency toward periodic vibration is thus removed.

All of the reciprocating parts, including pistons, connecting rods, valves, etc., are very much lighter, a fact which in itself contributes very largely to smoothness and absence of vibration.

Again, the "smashing" force with which the power impulses are ordinarily applied, is eliminated in this Cadillac Eight-Cylinder engine because the application of power is distributed over eight pistons—an impulse every quarter turn of the fly-wheel—another element contributing to smoothness.

The impulses overlap so completely that they melt and merge, as we have said before, one into another. When one power impulse is but half way on its stroke, another impulse begins and the impact on each is relatively light.

No severe shock or jar is communicated in these explosions. The process is not a succession of hammering blows, but rather like the touch of light and expert fingers sweeping the keyboard of a piano with almost incredible speed.

The net result is that unique sensation which tends to make you forget the presence of the engine—that sense of buoyance and of being borne forward by some means other than mechanical.

The basic power principle would not, of course, exercise its highest efficiency if it were not supplemented and supported by that painstaking construction in every other part of the chassis which is characteristic of Cadillac execution.

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